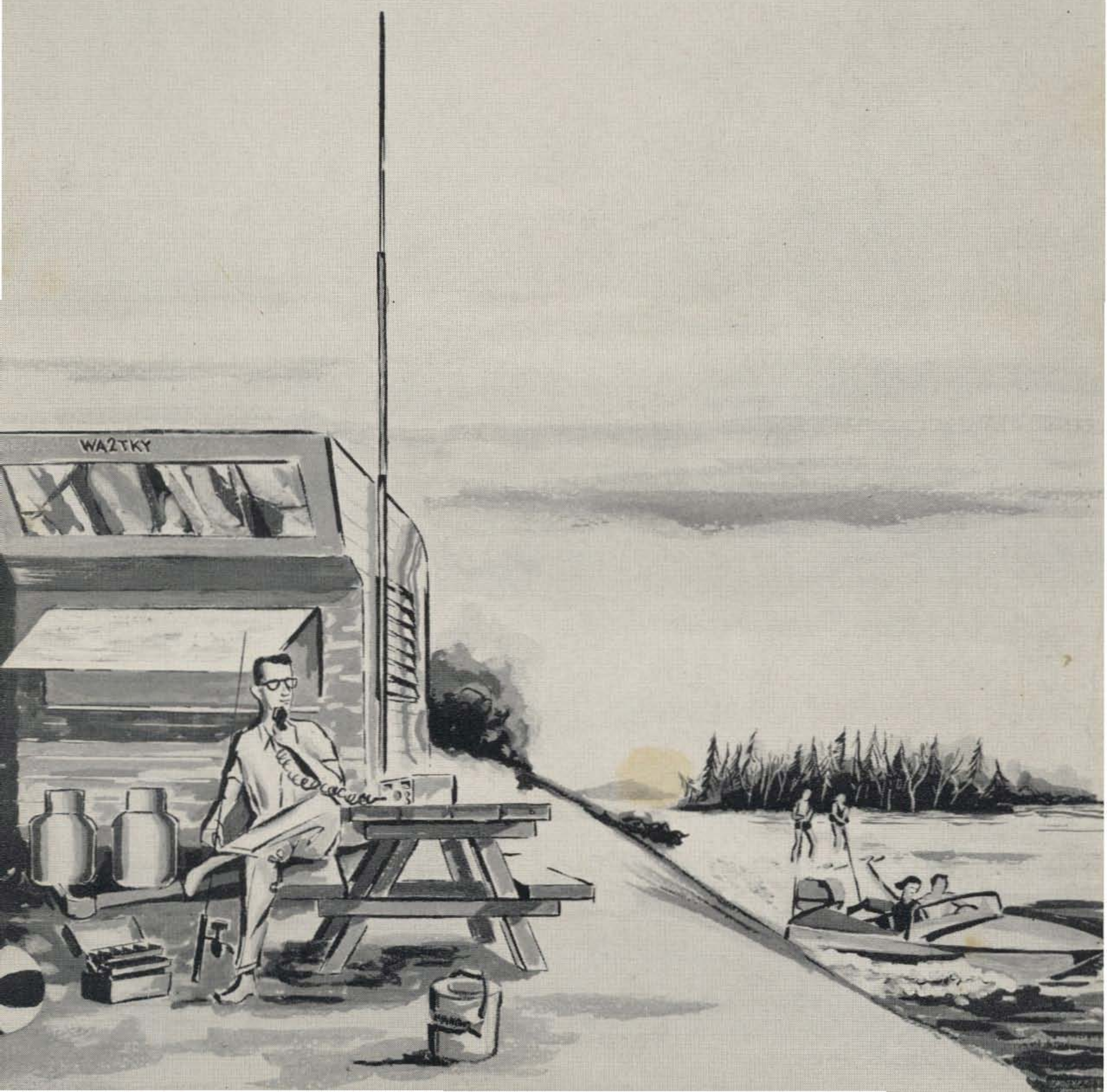
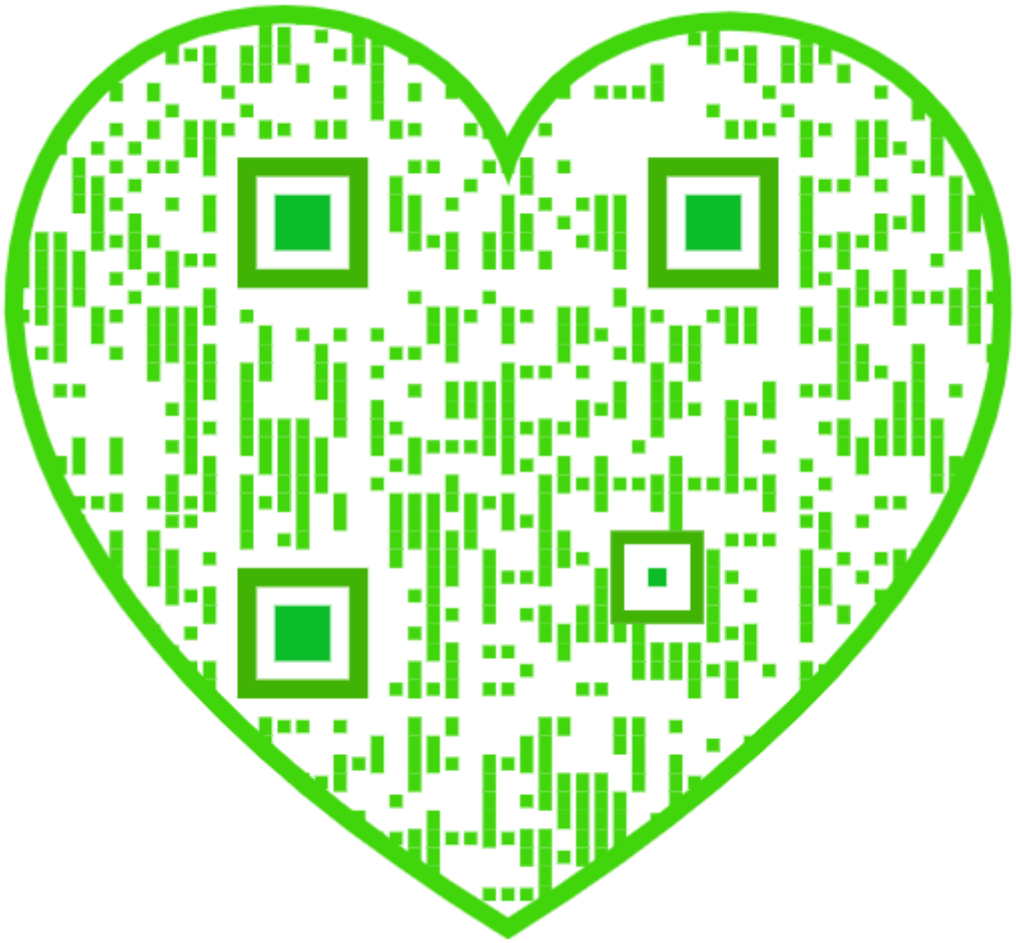
73 Amateur Radio

May 1964
Same Old 40c





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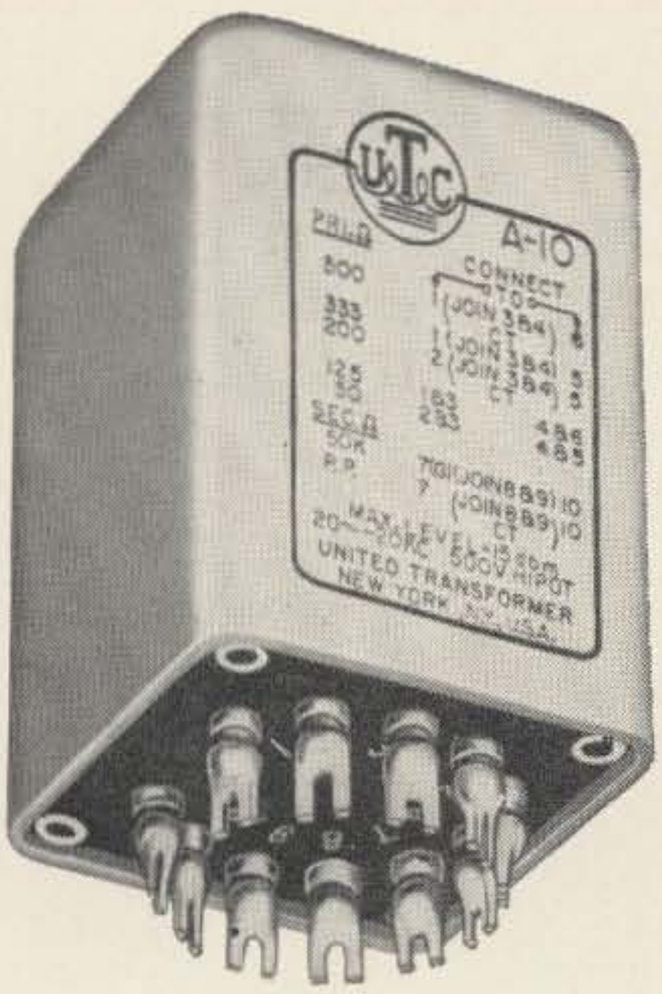
AUDIO TRANSFORMERS & INDUCTORS



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73

Magazine

Wayne Green W2NSD/1
Editor, etcetera

May, 1964

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2 pages	$420	$388**	$356**
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de W2NSD/1

never say die

Why Johnnie Can't Read

It's too painful. I can sympathize with John's problems. It must really bug him to get erudite letter after erudite letter telling him and the ARRL off, each with that little "cc to 73" at the bottom. I'll try to bring you little samples of the mail that somehow never makes it into QST in our letters department.

I understand that at a club meeting down in New Jersey in mid March, attended by Huntoon, a "League Official" publicly doubted the validity of the 73 poll of amateur opinion on RM-499. Johnnie, stop deluding yourself. The results of the poll are accurate and you *know* it. It doesn't seem possible that even wishful thinking could put that nagging figure of 80% opposed to 499 out of mind. Not only did the 73 poll give this figure, but we find the same proportion when we examine the FCC files on 499 in Washington. The mail received provides a similar tally, as do polls at hamfests where a count is taken without a Hoover brainwash.

Johnnie, even the polls being taken by your own Directors are giving you almost the same results (which you don't dare publish in QST). Wake up old boy. Don't try to sell us that 50-50 jazz, we all *know* it isn't so.

Johnnie, why don't you send Dick and a helper up here to count the ballots. I'll provide gas money round trip for them (from Connecticut) plus room and board while they are counting . . . (limit 30 days room and board to this offer). They will be provided all of the ballots we're received, our capitulation sheets, computer, a card table, and two camp chairs. We hope they'll be up for a visit and bring along a list of all of the chaps that they know of who have sent in favorable ballots to check against our ballots. They're all here, every last one of them . . . and a pitful few favorable votes there are.

World's Fair

The World's Fair in New York is an obvious place to show off our great hobby. Here is a place where we could show millions of people, including in all probability, virutally every foreign dignitary in the world, the value of amateur radio to our country. What a marvelous place to display evidence of the equipment we can design and build for ourselves, evidence of our unique ability to perform public service, and our ability to bring the world together through people-to-people communications.

Huntoon . . . front and center for a couple questions.

Johnnie, who, exactly made the arrangements for the exhibit? Who called Coca-Cola and suggested the exhibit? Who decided, and what influenced him to decide, that this exhibit would not contain one single item of home constructed equipment? Why have you decided to install a complete "appliance operators" setup? How did you manage to con the trusting clubs of the Hudson Division into agreeing to man this completely commercial installation? How are you going to explain this to your Directors this month? Will they accuse you of hypocrisy for talking technical achievement on the one hand and then pushing commercial equipment when it comes to a show down? Will they wonder why the equipment of one single manufacturer was chosen instead of using a cross section of several manufacturers? How will you explain this decision to all of the other manufacturers?

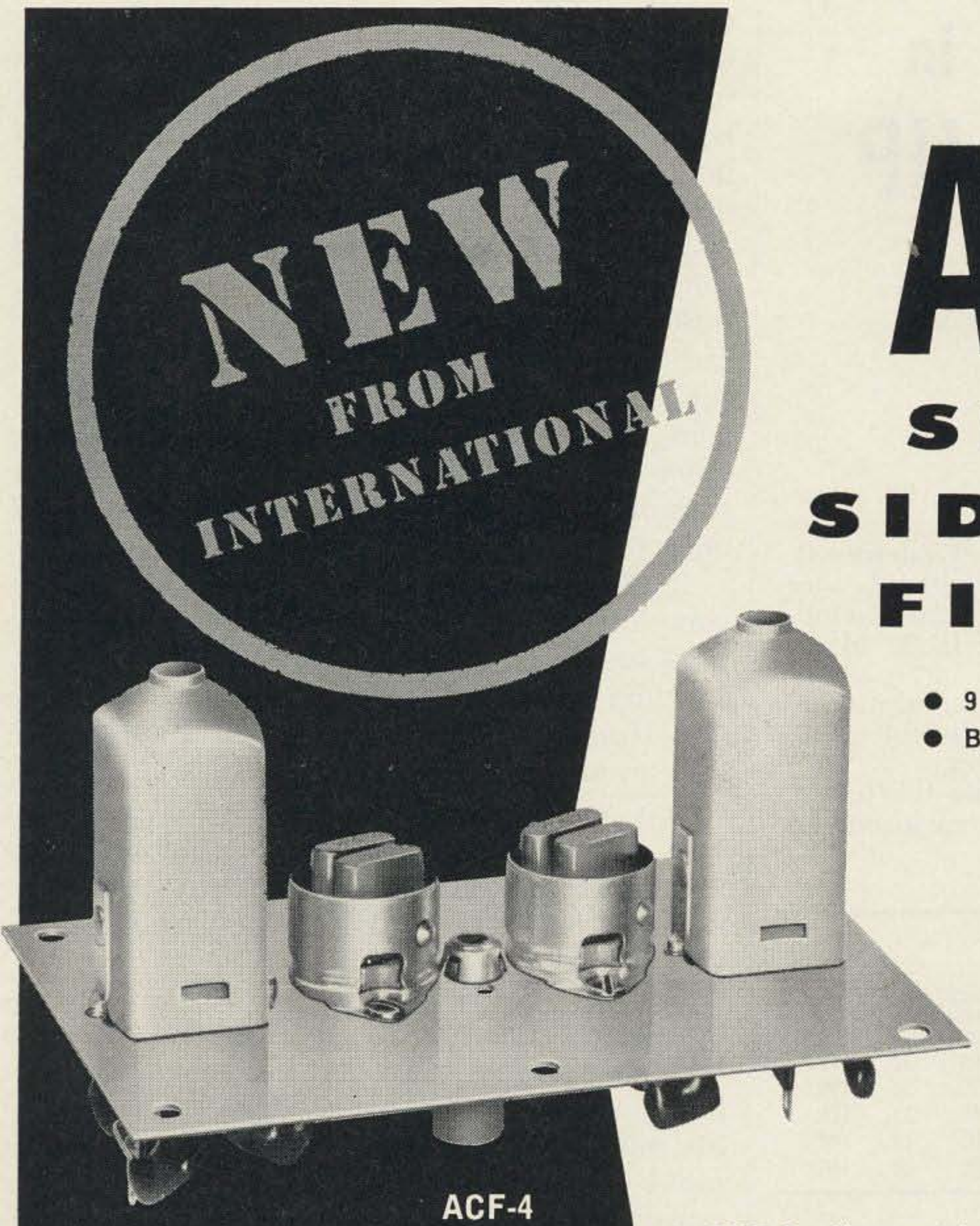
ARRL Fights Back

Since I have been sorely vexing the ARRL of late I naturally expected some sore vexation in retribution. The S. V. has arrived. "73 Magazine is not acceptable as an exhibitor at the 1964 ARRL National Convention." My vex is very sore. It fair brings tears to my eyes

NEW FROM INTERNATIONAL

AOC*

SINGLE SIDEBAND FILTERS



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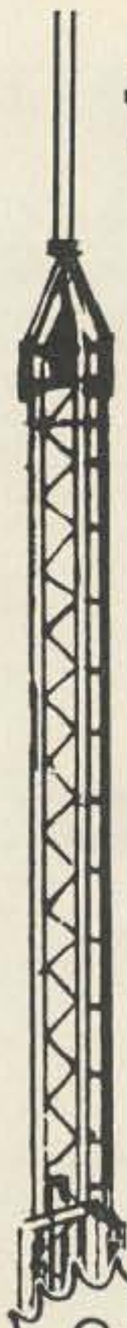

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TORBZ 66-3	8.2	66	90	50	100	32	150
TORBZ 75-3	17.0	75	60	55	86	33	125
TORBZ 75-3	10.0	75	75	55	100	33	140
TORBZ 88-3	12	88	60	65	86	38	140

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when I think of the tens of loyal ARRL camp followers who will be robbed of their golden opportunity to spit epithets in my face. My heart renders when I think of the hundreds of dollars we will save in not driving all the way down to rotten old New York in the middle of ghastly August. I tremble in dismay when I think of the poor families of those gouging porters who take hours to carry a small box to our postage stamp sized $200 exhibit space . . . the one over in the corner behind the pole. Alas, I will miss those canasta games with the other exhibitors while waiting vainly for someone to come to our exhibits, even if only to try to steal something.

It is not terribly depressing, when one has completely accepted a seemingly unavoidable unpleasant fact, to suddenly be reprieved. Virginia and I had decided that inspite of the first Hudson Convention back in 1960, which we considered a fiasco, and the second in 1962, which we prudently avoided (if we are to believe the dismayed groans of some of those who did attend), that we would support the National Convention this year, even if it cost us our shirts.

If you really want to see 73 at the Convention and promise to buy a subscription, some books, or maybe an Institute membership, then first you've got to convince Huntoon to change his mind. Now I doubt if Hunty changes his mind easily, particularly when he's emotionally upset, so you'll have to be very convincing. The basic question is this: is it really fair for the ARRL to force us to save all that money by such a sneaky action?

My March editorial apparently bugged Huntoon for a mailing went out to all affiliated clubs picking out three of my hints at possible things to come, labeling them flagrant misinformation. No doubt a few clubs will dutifully pass along this letter as Gospel. It is bound to happen that some will look into 73 and see that there is a lot more flagrant information than flagrant misinformation.

Auto-Call, the club paper for 17 radio clubs in and around Washington, D. C., devoted considerable space to my editorial, including many quotes from it.

RM-499

W4TYH and K3VUQ went through the FCC files on RM-499 and reported that there were about 3000 items in nine file folders. Some were petitions, some were individual comments, others were letters of inquiry. It took all one day to sort out the mass. They found that between 80 and 85% of the amateurs

(Turn to page 85)

COMMAND THE BAND

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Regardless of the exciter you are now using—the HX-50, the HX-500, or any one of a host of compatible competitive units, you will TAKE COMMAND the moment you're hooked up to the incredible HXL-1.

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Strong Noises — Weak Signals

or

The Flying Noise Lock System

Like the weather, every one cusses noise but few attempt to do much about it, except trying to learn to squint their ears, which isn't easy.

Noise comes in various forms and intensities and it is pretty hard to find any two of the hundreds of noise definitions in print that describe the same thing.

For our purposes, let's say noise is detectable energy that never happens twice in the same place or the same way.

This lets out ignition noise, power line leaks, rotating or vibrating contact arcing; i.e.: repetitious pulse trains of wide bandwidth; for modern circuitry—noise blankers—rhododendron swamp hole punchers, etc., have pretty well settled their hash.

We are talking about electron motion noise. That non-coherent crud that is generated in infinite amounts throughout the whole galactic universe; measurable amounts when current is passed thru a hot resistor; and microwatts of which, in the input stage of any receiver, keeps us from hearing weak signals. "Johnson noise" as it is usually termed, is smooth and evenly distributed, but totally non-coherent. If a channel of 10 kc width centered at 450 kc was mixed with a channel of 10 kc bandwidth of the same shape factor but centered at 460 kc in a linear mixer the noise in each channel would neither add nor subtract, you would just get noise. The instantaneous peak value depending on the value in either channel at that instant and the gain or loss in the linear mixer.

This is an extremely controversial subject and the above definition treads on some highly educated toes, but remember nothing was mentioned about averages, non-linear detection, pre- or post-detection integration or attempting to measure finite values of noise power. All of these complicate the above picture to the nth degree and has been known to drive long friends at each other's throats with bare knuckles, knashing teeth and bloodshot eye.

Since we aren't going to discuss any of these, let alone try to use them in practical circuits, we will let the communication theory hounds worry these points into obscurity.

If you were to look at the output of one of the forementioned *if* channels with a wide-band, ultra-fast rise and fall-time scope operating well below the overload point, you would describe the pattern as very fine, continuously changing grass growing equal distances up and down. Widening the pass-band of the *if* channel would make the grass finer in changing detail and severely narrowing it would give a coarse, ever changing structure. At any instant in time it can have any amplitude, frequency or phase and it may or may not be the same at any other instant—in other words, complete non-coherence. It is extremely doubtful that noise in this state can be modulated or detected without serious changes in its basic structure.

Mixtures of very weak signal and lots of this type of noise are extremely difficult to picture. It is not really known if the noise rides on top of the signal or vice versa or whether they just intermingle. We do know that any attempt to measure or detect any part of this mixture with a non-linear or averaging circuit of any kind wipes out the smaller variations and squelches out the weak signal. By weak signal, we mean one whose peak value is 20 to 30 db under the peak values of the associated Johnson noise in the circuit. By using all linear circuits in your rcvr (product detector-BFO, etc.) CW signals that are 30 db below the peak value of the noise can be heard and with long practice slow CW can be read by a very expert ear when approximately 20 db below the noise peaks. It is doubtful that unknown signals of these intensities can be located or acquired by tuning this type receiver unless they peak up occasionally to much higher levels.

The commercials and military people have a number of systems that can pass useful information over circuits where the received signal is this far down in the noise. The majority of these are closed loop systems of

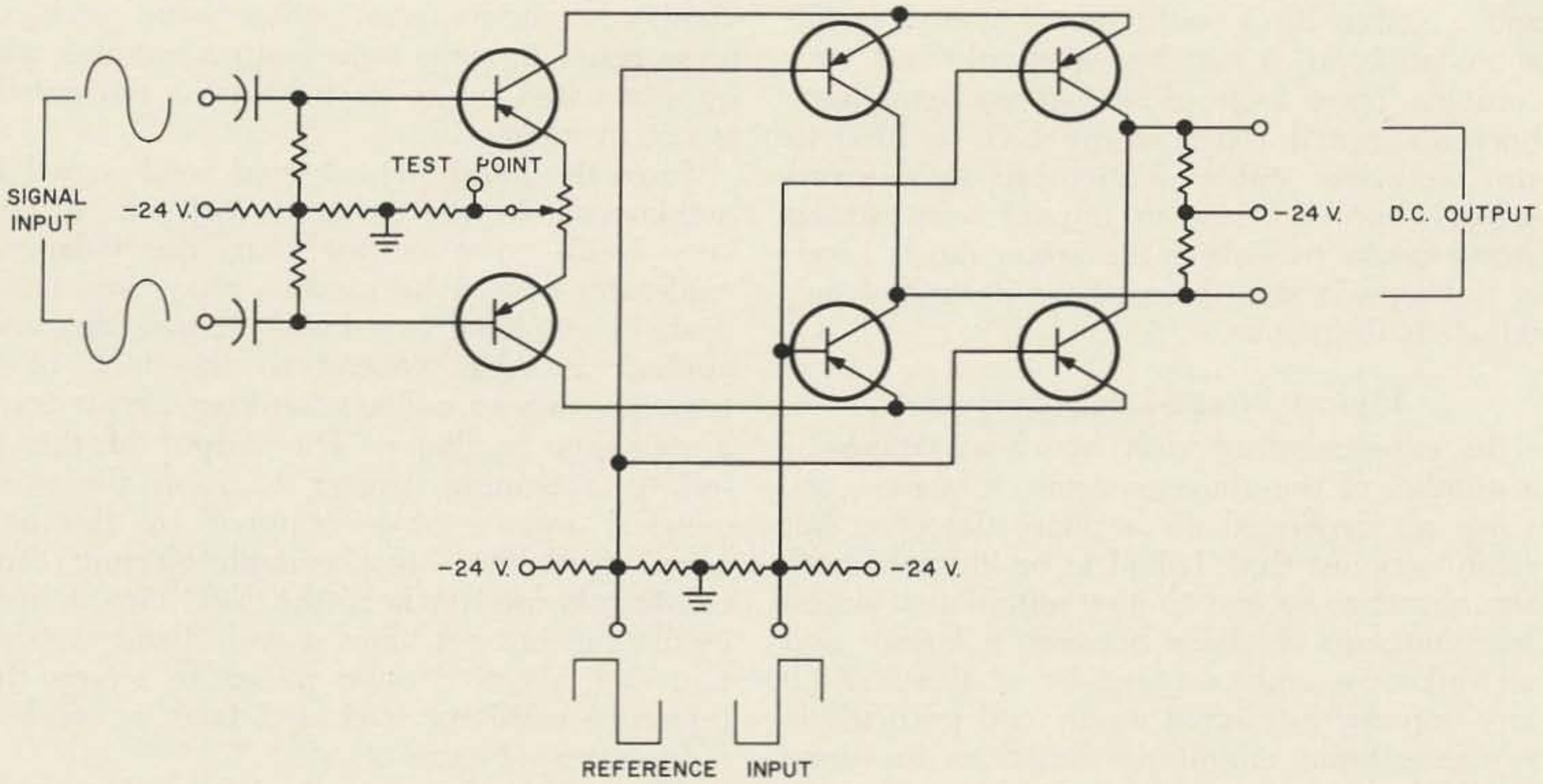

FIGURE 1

little value to independent amateur operation. In these, some definite form of information is included in the transmitted signal and the receiver does not actually detect but correlates to locate this pattern of information out of the morass of noise. Another way to describe this —a key shaped block will only pass thru a key shaped hole—the round, square, oblong and triangular ones are ignored. If the receiver knows exactly the frequency—in fact, the exact received phase of the desired signal, then digging 30 db inside the peaks of noise is no problem.

What then, could two independent amateurs, half way around the world from each other, do to realize some measure of improvement in very weak signal in the presence of strong noise reception? This might be on 20 meters when the band is dead or on 432 mc using the moon as a reflector, but we must have a channel that is free of QRM. We want to get below that weak signal threshold that is so apparent in every receiver when a weak signal fades abruptly into the Johnson noise of its front end.

Many schemes have been tried by various amateurs—use of WWV as the phase lock identification; Dicke Astronomy setups with high speed switching between antenna and controlled noise source with synchronous detection, to achieve a hair-trigger balance that nulls out all receiver noise; and the only one that has given any concrete results—fantastic stabilization of the transmitted frequency to the extent that phase coherence between it

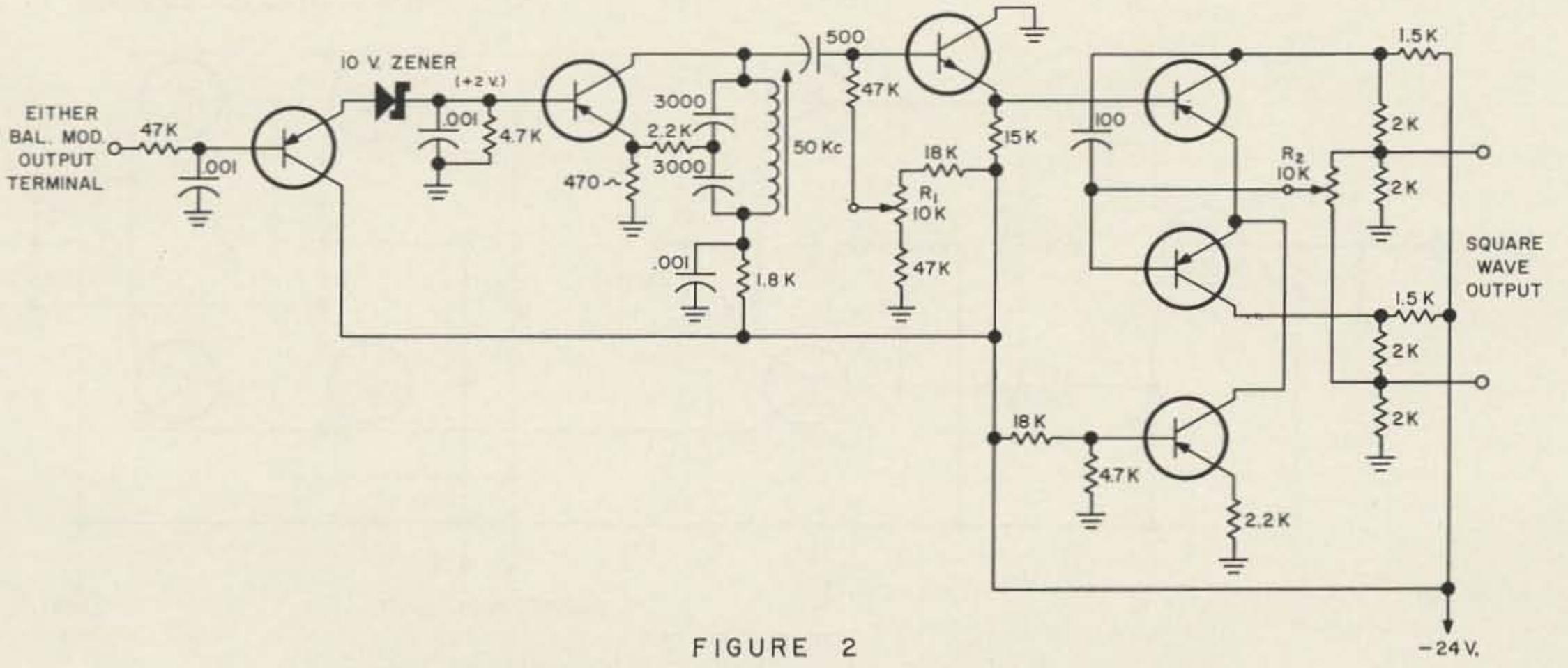

FIGURE 2

and a stable BFO could be integrated inside a human head. A number of simple and very complex open loop phase-lock systems have been attempted (AFC of the L.O. or BFO to stay in phase stable relationship to received signal) but all seem to require very strong signal peaks to lock up so aren't much good, or noise peaks kick them off the desired signal, which is disastrous.

Flying Noise-Lock System

In experimenting with many variations of a number of the above systems, it became obvious all depended on a phase detector that really was just that. It had to be linear to both signal and noise and to give output that was a true measure of phase between a known and an unknown and to reject by at least 30 db any improperly phased inputs and particularly suppress input amplitude variations for these would be primarily noise. Since inventing such a circuit could be hard work I spent some time in research (lifted the circuit from a piece of equipment designed for another purpose). This is a double-balanced modulator that really is almost idiot-proof (Figure 1).

The diagonally opposed transistors are switched on and off by the square wave reference frequency. When they are switched on they are amplifying in a linear manner during that half cycle. In this way when the incoming signal is exactly in phase with the reference, the two transistors connected to one collector load resistor draw increased current and the other two less so there is a several volt dc difference between the collector ends of the balanced collector load resistors. 180° phase difference reverses this dc difference, and random phase gives zero dc output.

Random phase relative to the references or amplitude variations at either input such as noise result in some noise output but this will be attenuated by at least 30 db if the circuit is not overloaded.

Since the phase of a desired weak signal is not known, we are going to look for it. The very weak noise output from the balanced modulator caused by random phase and noise peaks is amplified in a linear dc amplifier and applied as AFC control to the base of a transistor whose collector-emitter circuit form a reference oscillator. The output of this is fed to a Schmitt trigger to form the symmetrical square wave required by the balanced modulator. Just enough filtering time constant is used to keep the AFC circuit from oscillating, but yet allow a wide band of positive and negative noise pulses to sweep the reference oscillator back and forth at random noise rates (Figure 2).

The result is very complex but can be simply described by the apparent action. It appears to lock up on every random noise pulse that gets thru the balanced modulator. If this pulse is moving in frequency—so does the reference oscillator—locked on. During this instant there is dc output from the balanced modulator for the oscillator is either exactly in phase or out with the noise pulse and this establishes the flying lock. But a noise pulse doesn't last—it moves clear off frequency or dies in amplitude and at its AFC minimum threshold the circuit jumps to the next best noise pulse available. This may result in the oscillator locking up in the same phase or opposite resulting in dc output from the balanced modulator of opposite polarity. Because noise is completely random the output circuit flops back and forth in polarity and amplitude of dc in a totally random manner for there are are just as many flings as

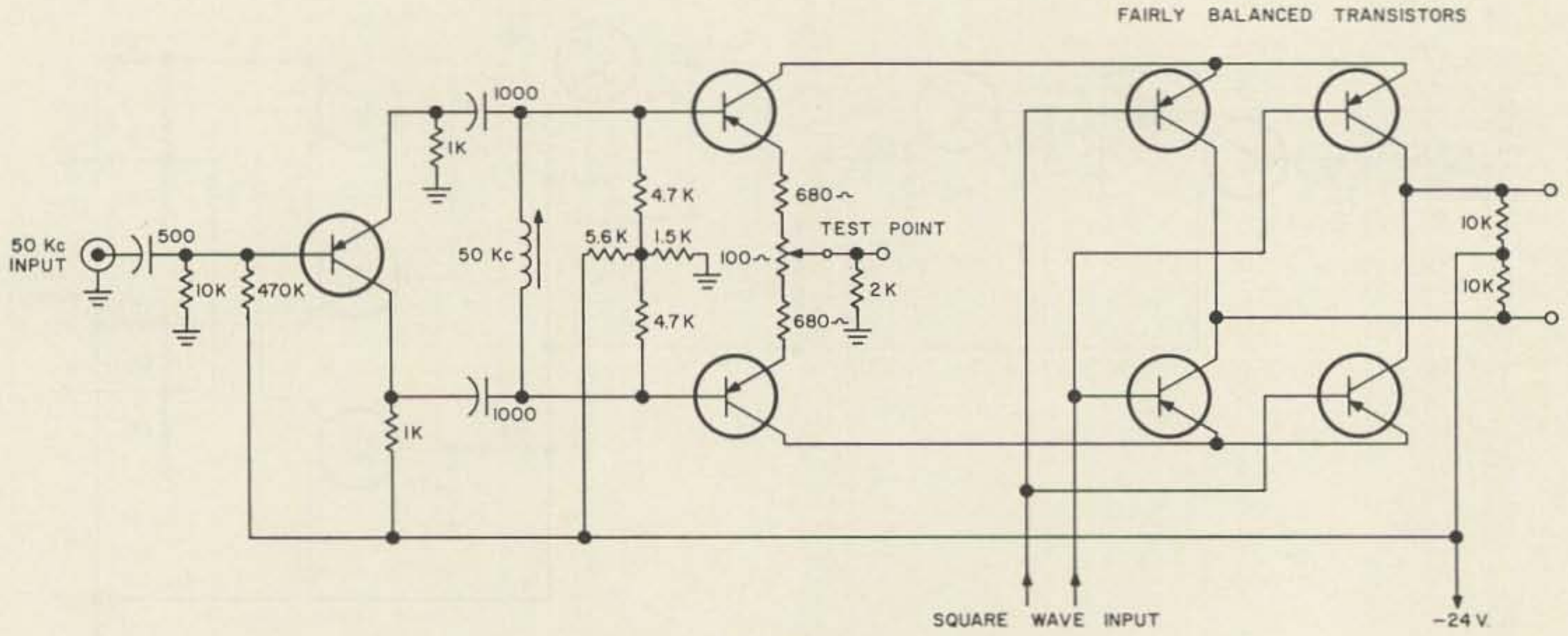

FIGURE 3

There is just no better way of getting started in VHF than with the newest of the new in the Clegg line — the 22'er two meter transceiver. This ready-to-go station combines many of the fine features that have made the Clegg name famous in VHF ham circles for years plus refinements to make 2 meter AM phone operation more interesting and challenging. It is realistically priced — your distributor will have complete information.

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8. Broad Banded Transmitter Circuits for ease in QSY
9. Push to Talk
10. Transmitter frequency spotting switch
11. Provision for (external) linear amplifier and VFO
12. Conservative 11 watt rating (input)
13. Unit will operate with either 8 or 12 MC crystals
14. Self contained universal power supply for 115 Volts AC and 12 Volts DC
15. Tube line-up

V1	6CW4	Rcvr RF
V2	6DJ8	Mixer/VLO Tripler
V3	6DJ8	VLO/Cathode Follower
V4	6AU6	2nd Mixer
V5	6BA7	3rd Mixer
V6	6BA6	IF Amplifier
V7	6AL5	Diode detector/Noise Limiter
V8	12AX7	AF Amplifier/AF Amplifier
V9	6BQ5	Rcvr Audio Output/Xmtr Modulator
V10	6EA8	Xmtr XLO/1st Multiplier
V11	12BY7	Buffer Amplifier
V12	12BY7	Xmtr Driver
V13	2E26	Xmtr Final Amplifier

Squires - Sanders, Inc.

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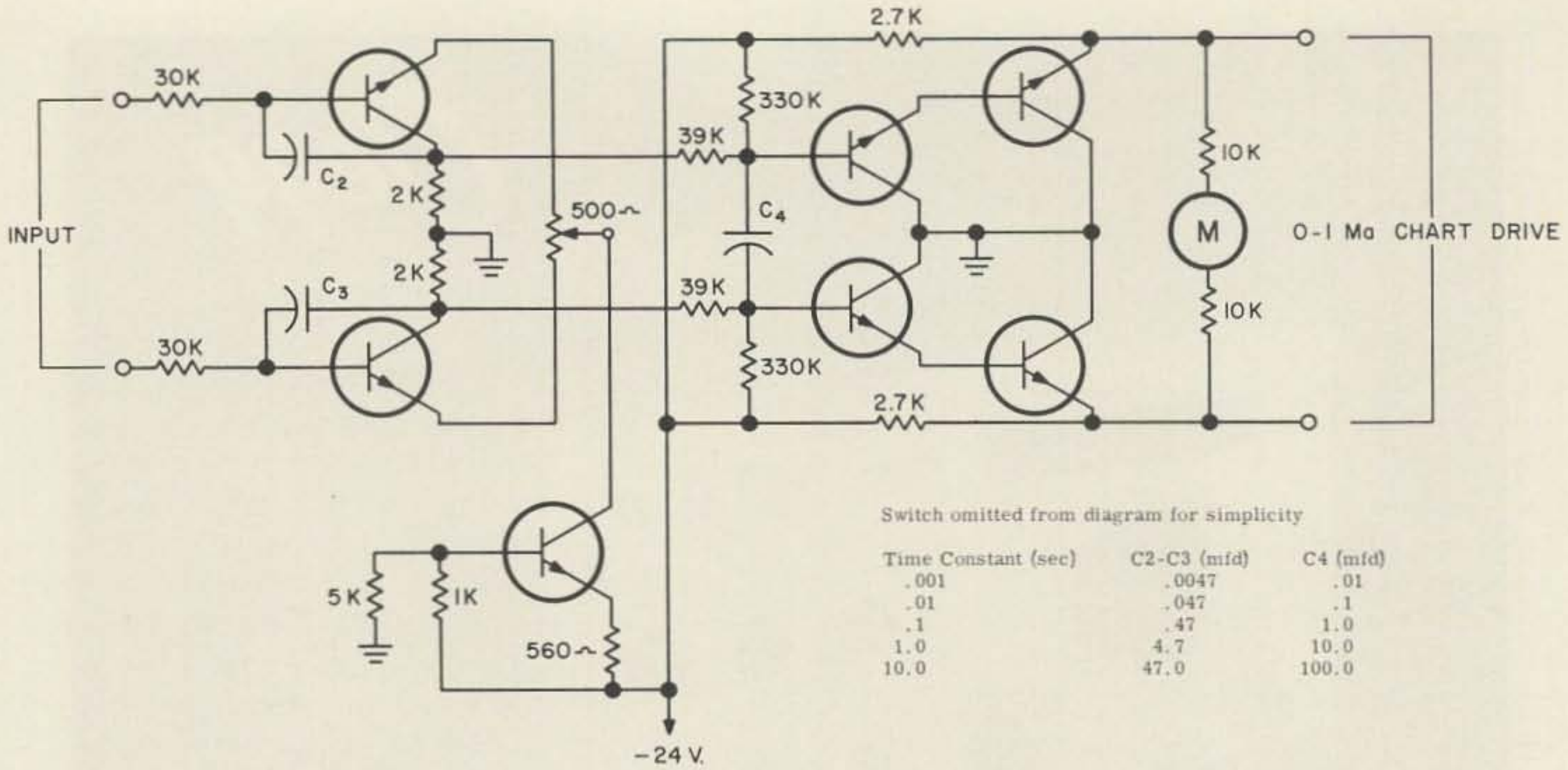


Switch omitted from diagram for simplicity

Time Constant (sec)	C2-C3 (mfd)	C4 (mfd)
.001	.0047	.01
.01	.047	.1
.1	.47	1.0
1.0	4.7	10.0
10.0	47.0	100.0

FIGURE 4

there are flangs even during a few miliseconds (Figure 3).

By means of a cathode or emitter follower, a volt or so of linear *if* signal is stolen from the last *if* in the station receiver. The BFO and all non-linear detectors must be decoupled or disabled.

This linear *if* output is fed to a split phase inverter to feed the double balanced modulator, rather than use a center tapped *if* transformer that could restrict or modify the frequency response at this point. The balanced driver transistors match the input impedance of the emitters of the balanced modulator. The total gain of these stages is not enough to produce non-coherent noise at the output without *if* input so that the reference oscillator rests on its natural frequency which should be approximately centered in the *if* passband of the receiver.

Under normal operating conditions, observation should be made occasionally with a high gain scope between the input Test Point and ground. Any evidence of signal at this point indicates severe overload of the balanced modulator and *if*-rf gain in the receiver should be reduced.

Tune the receiver across a fairly weak signal. The reference oscillator will lock up as soon as the signal is in the pass band of the *if* and balanced modulator. Several volts of dc difference is potential between the balanced modulator collector load output terminals will be in evidence. Upon tuning the signal thru the center of the *if* passband this dc output will flop to the opposite polarity as the reference oscillator locks in the opposite phase. This will hold till the signal is tuned out of the *if* passband and the reference oscillator AFC lets go and the oscillator heads for center, then random noise in the AFC loop starts the whole system searching at the noise rate again; it is looking for signal!

With very weak signals the operation of the flying noise lock system is slightly different. It will be necessary to add a high-gain, variable time-constant dc amplifier for the resultant dc shifts from weak signals may be 30 to 50 db below the peak swings from noise (Figure 4).

As outlined before, during no signal condition, the dc output from the balanced modulator flops back and forth at a random rate. By introducing longer time constants in the indicator amplifier, we can reduce the amplitude of these swings caused by short pulses of noise without interfering with the circuits' ability to indicate dc shifts that are caused by signals of longer duration than the time constant used.

Really weak signals will not indicate a locked up oscillator AFC but the indicator circuit will register more swings or "hits" toward one polarity than the other. Tuning across a very weak signal slowly will show increased hits toward first one side than toward the other as the signal modifies the phase on either side of the *if* passband.

This flying noise lock system tends to integrate hits when signal is present even in extremely small amounts. Use of some time constant in the indicator amplifier slows down the irregular swings of the output due to noise, but doesn't interefere with the output swinging over and staying there when signal is present

then going back to the irregular swings centered around zero during no signal (Figure 5).

This Schmitt trigger circuit can be used across the recorded output of the indicator amplifier. This circuit keys the relay from the differential output and this keys an audio oscillator so slow CW can be read by ear. With very weak signal there will be errors in keying caused by noise pulses but the over-all result is far better than attempting to directly read a signal buried this far in the noise. For really solid results under very weak signal conditions a pen recorder allows reliable integration of signal hits actually thru the valleys of the noise pulses.

Without signal, there should be approximately 1 volt, peak to peak, of undistorted noise (measured with a wide-band scope) at the base of the reference oscillator. Attempts to increase this time-constant, or AFC filtering, will make this system a normal phase-lock affair, with attendant poor performance in acquiring weak signals. At the same time, any non-linearity in any part of the system. Particularly before the balanced modulator will wipe out weak signals.

This system digs out the information that a signal is there—now we must teach ourselves how to use the result to efficiently communicate. There are several approaches being looked into, probably one of the best is toward the use of a digital sampling integrator circuit following the balanced modulator. Allen, K2UYH is working in this area with excellent promise.

The Flying Noise Lock system is completely and dynamically unstable during no signal conditions. But if anything shows up in the *if* passband that even is slightly coherent or that happens twice in the same way, the system locks up and narrows down. Under minimum detectable signal conditions, noise peaks kick it off but it goes right back to the signal. Without signal, tune the BFO across the noise *if* on a standard receiver—this crud is just the type of information the Flying Noise Lock system lives on. Use of phase modification information from a really good double-balanced phase detection circuit is something radically new, so don't knock it until you have tried it.

It is not possible, at this time, to plug in numbers proving just how sensitive this Flying Noise Lock system is. I do know that it will reliably indicate signals that are buried further in the Johnson noise than anything ever seen at this QTH. The system completely ignores all types of pulse type noise just as though it wasn't there, as long as they do not saturate the rf-*if* section of the receiver. It would appear this is the best presently known means of invading the never-never land of better than —200 dbm in minimum detectable signal sensitivity. Just trying to calibrate signal and noise generators at these levels is quite a job. On the air testing is slow for at —200 dbm there is no such thing as a dead band—just a morass of birdies and harmonics that are below the thresholds of any other receiver. We have succeeded in getting a firm grip on this tiger's tail—a little taming and we will be cranking 30 to 50 db improvements into communication range equations. A quick look at any of these and it is apparent why the last five years and the next is well worth any possible effort—get in and get your feet wet!

. . . K2TKN

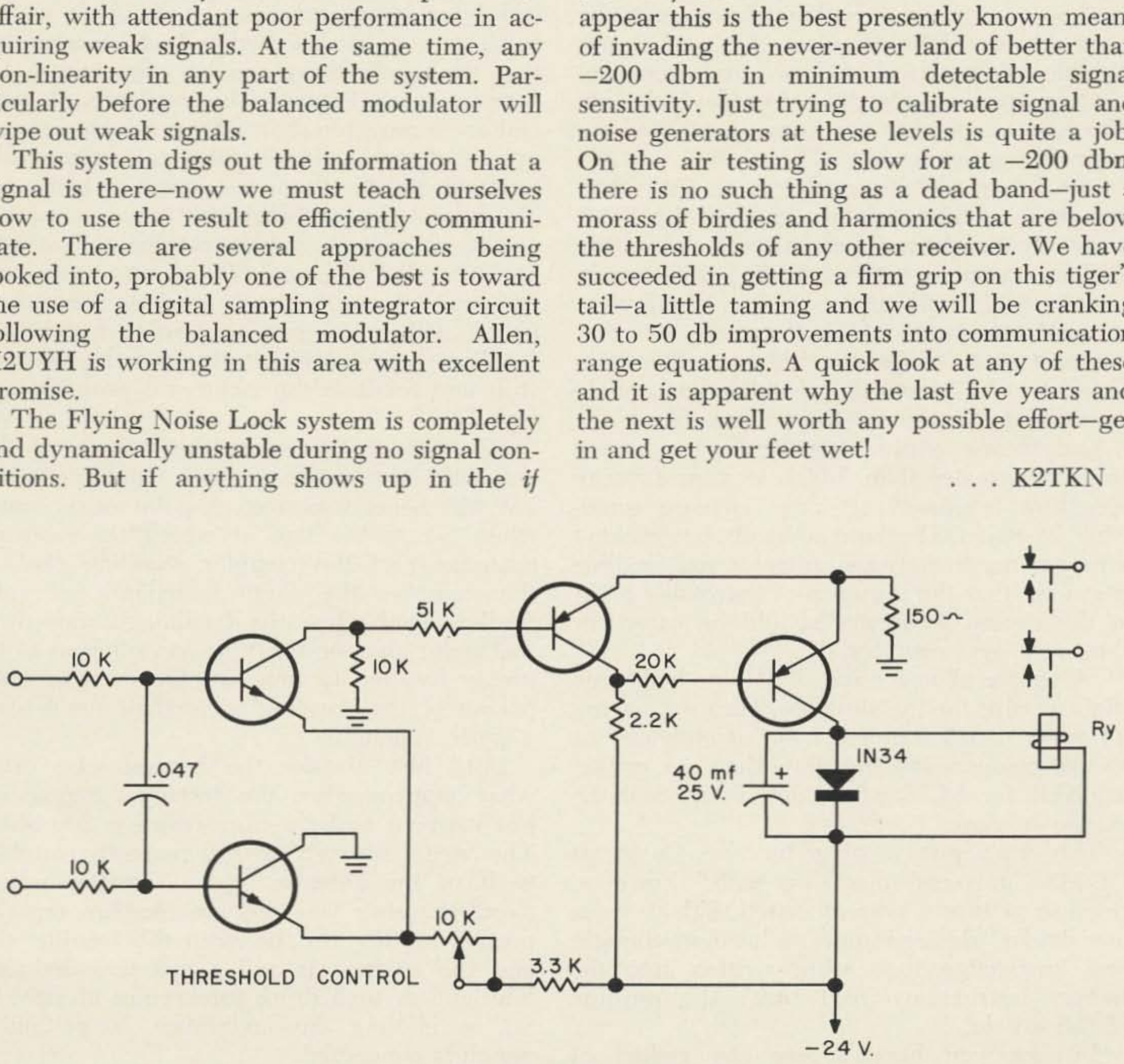


FIGURE 5

Matching the VHF Antenna

Jim Kyle K5JKX

It's pretty well established by now that for anything at all more than low-power local ragchew purposes, feedline loss can't be tolerated at VHF. Granted it's not always possible of practical to use that beautiful low-loss open-wire feedline—but anybody *can* take care to see that the losses in his line are as small as possible.

One cause of increased loss is SWR. Although the additional loss imposed by SWR is usually considered unimportant unless the SWR is extremely high or the line is extremely lossy to begin with, the extra loss is still present and often can add just enough to other loss factors to make the difference between easy copy of a "deep-fringe" station and merely detecting his carrier in there somewhere!

And there's really little excuse for having an SWR greater than 1.001 at your favorite operating frequency. It may increase somewhat as you QSY about a band, but making a proper match between antenna and feedline is so easy that the presence of detectable SWR at the chosen frequency should be cause for shame to any operator.

A couple of years ago, VHF ops had some slight excuse for the situation, because making a perfect match required a bit of ingenuity or special components. But now, there's a gadget available for $4.75 which does it all—and the excuse is gone.

This isn't just a plug for the Cushcraft CL-MS "universal matching stub," however, because getting a *perfect* match with this (or any similar) device requires a bit more thought and knowledge than were written into the factory instructions. And *that's* the purpose of this article.

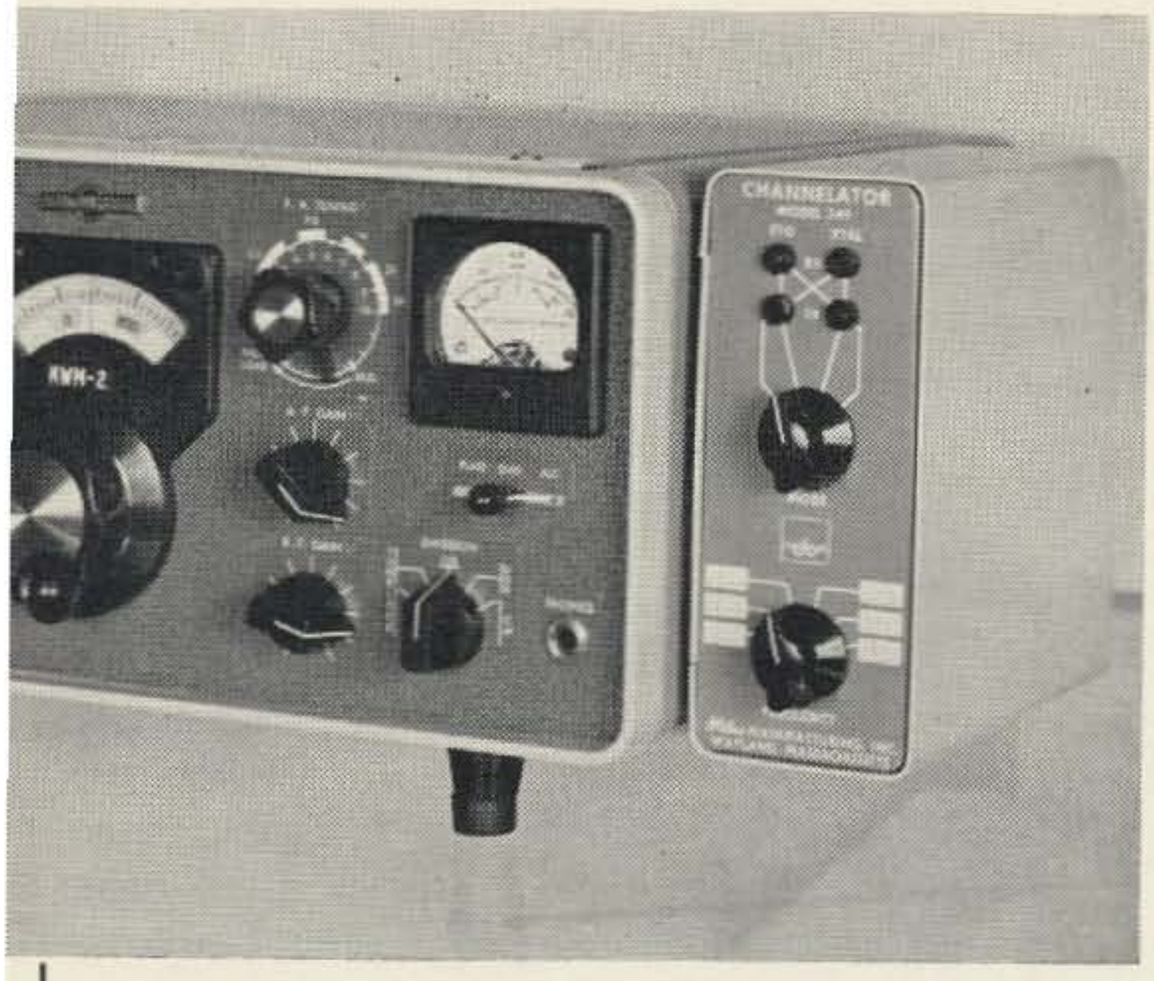
In case you haven't seen the gadget, it consists of a pair of aluminum rods, ¼ inch in diameter and 42 inches long, spaced 1⅝ inch center-to-center and supported at either end by a polystyrene insulating block which fastens to a modified twin-lead standoff so that the whole thing can be clamped to the antenna mast. Between the insulators at each end are a movable shorting bar which can run up and down the rods, and a pair of movable terminal points (one per tube) which can also be put almost anywhere.

This amounts to a half-wavelength (at 144 Mc) parallel line of 300 ohms surge impedance. According to generally accepted belief, such a line can be used to match any feedline to any antenna, provided the shorting stub and feedline tap point are properly adjusted.

However, it ain't quite that simple. If the antenna's impedance is fairly high or fairly low, the belief is correct. A point exists somewhere along the line at which the resistive component of the complex standing-wave is the same as the surge impedance of your feedline, and when the feedline is moved to that point and the shorting bar adjusted to its proper location to tune out the reactive component of the standing wave then you'll have a perfect match.

But (just to take the hardest case first) what happens when the antenna's impedance just happens to be a pure resistive 300 ohm? The "matching stub" is then perfectly matched *itself* to the antenna, and no matter where along the stub you put the feedline tap the portion of the stub between the feedline tap and the antenna is still a matched 300-ohm line, and as such drops forever out of sight so far as offering any assistance in getting a match is concerned.

To plug in a specific example, let's say we're



KWM-3

?

Well, almost . . . the Waters Channelator™ is one of the biggest improvements you can make in a KWM-2/2A. The Channelator has six crystal positions which can be used for transmitting, receiving, or both, or the PTO can be used for one and a crystal for the other. Instant bilateral transceiver.

Since most of us have two or three channels where we usually talk, the Channelator is ideal. With a flick of the switch we can check the net frequency and call in or just listen. In the car we don't have to carefully tune from one channel to another and don't have to retune the dial every time a leg hits the PTO knob.

Or perhaps you like to work DX. You can flip in a crystal for the transmitter, knowing that you are in the band, and go hunting with the PTO for the receiver. You can check your transmitter frequency with a switch flick at any time for QRM.

MARS members can put in two or three MARS channel crystals and flip from one channel to another with the one switch . . . mobile or at home.

The Channelator is designed to fasten to the side of the KWM in a few moments without the slightest marring of the cabinet. It takes its power from the accessory socket in the KWM (thus will operate with any KWM power supply). There is one simple solder connection to make (which you can reach from the top) and a plug to put in . . . and you're in business. The crystals for the Model 349 Channelator are available from Waters for $6 each. There is a pad on each crystal which will vary it over ½ kc either way so you can zero in exactly on a net channel. Specify whether crystal is for USB or LSB.

The Channelator is now in stock at most ham distributors around the country. The price is only $79.95 (less crystals).

The Channelator and all the other Waters ham products are given the full treatment in the new Waters catalog. Send for one.

Waters Manufacturing, Wayland 73, Massachusetts

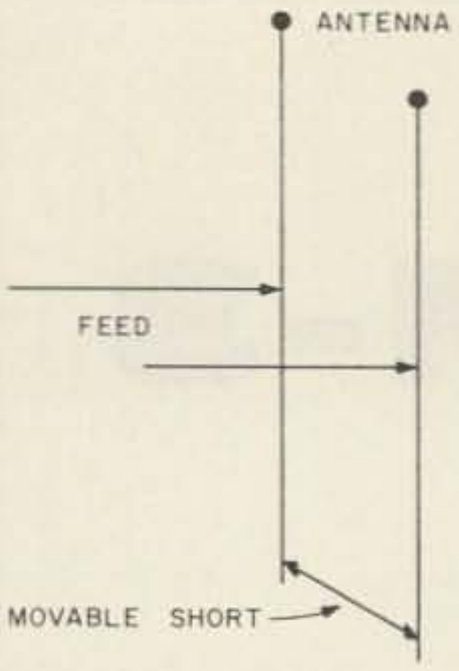


FIGURE 1

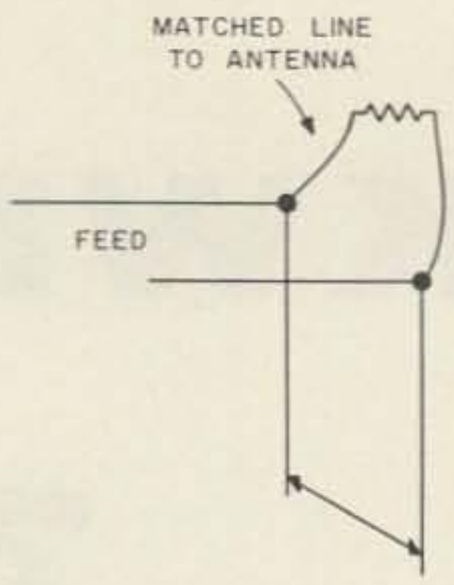


FIGURE 2

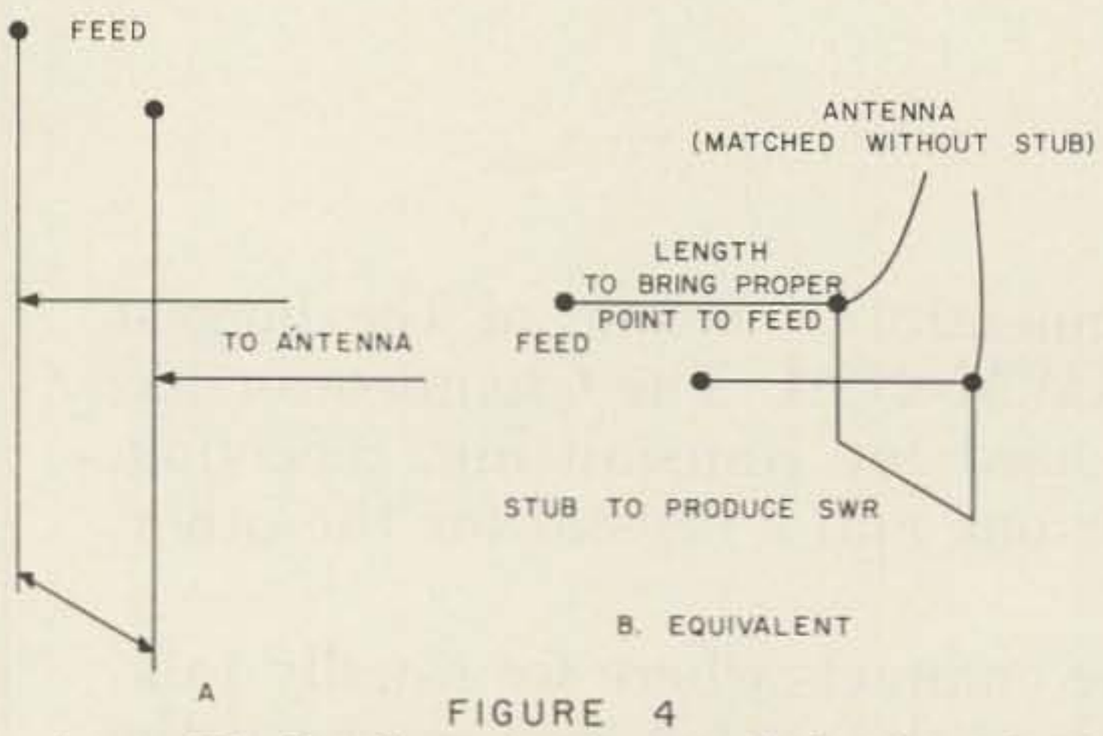


FIGURE 4

using a 52-ohm line (without a balun) to feed an antenna which happens to be exactly 300 ohms, matching the stub impedance. The only place on the line we can find a resistive point at which to feed is ¼ wave above the shorting bar (the resulting ¼-wave shorted stub effectively isn't there) and the best *resistive* SWR we can obtain will be 300/52 or 5.77 to 1. Not good. Toying with the stub length may reduce this a bit by putting in low resistance and fairly low reactance, but we'll find it virtually impossible to get far below 2-to-1 SWR.

At this point, let's pause and look at some pictures. Figure 1 shows the general arrangement and factory-recommended hookup of the "universal" stub. Figure 2 shows what happens in effect when the stub is perfectly matched to the antenna. Figure 3 is a graph showing reactance of a shorted 300-ohm line and of an open 300-ohm line (resistive components depend upon so many variables that no graph can be given for them'.

By plugging the values from Figure 3 into Figure 2's effective hookup, you can readily see why the recommended arrangement cannot work whenever the stub is a perfect match to th antenna itself. If a mismatch exists between stub and antenna, then any feedline impedance within the range Zstub/Zant to Zant/Zstub can be matched, but impedances outside this range are also out of luck so far as matching goes.

The real sharp-eyed among our readers will have noticed by now that, from Figure 3, the reactance *anywhere* on a quarter-wave resonant line (a quarter wavelength long, one end shorted and the other end open) is always zero. At a point 1/12 wavelength up from the shorted end, for instance, the reactance looking toward the short will be −519 ohms (distance to short) while that looking toward the open end will be +519 ohms (distance to open) and the sum of the two is zero.

This offers a possibility of turning our gadget into a truly universal matching device; regardless of the antenna or feedline impedances, any one can be made equal to the value of the other plus a parallel *third* resistance, and the resistive component of this resonant line can offer this third resistance.

For instance, a third-resistance value of about 63 ohms would reduce our antenna resistance of 300 ohms down to the 52 ohms necessary to match the feedline. And the quarter-wave resonant line which results when the shorting bar of the matching device is placed exactly a quarter-wave down from the open end of the gadget offers a handy variable RF resistor.

Unfortunately, it doesn't work that way. Q of the line at 2 meters is about 2000, and when all the slide-rule work is done you come up with a tap point less than ¼ inch away from the short. In addition, five times as much power goes into the matching device as into the antenna; it ain't quite worth it.

But don't give up hope. There's another way. It's not quite so easy to see at first glance, but it works and works well. A full description of exactly how it works would require pages of involved math and a few Smith charts

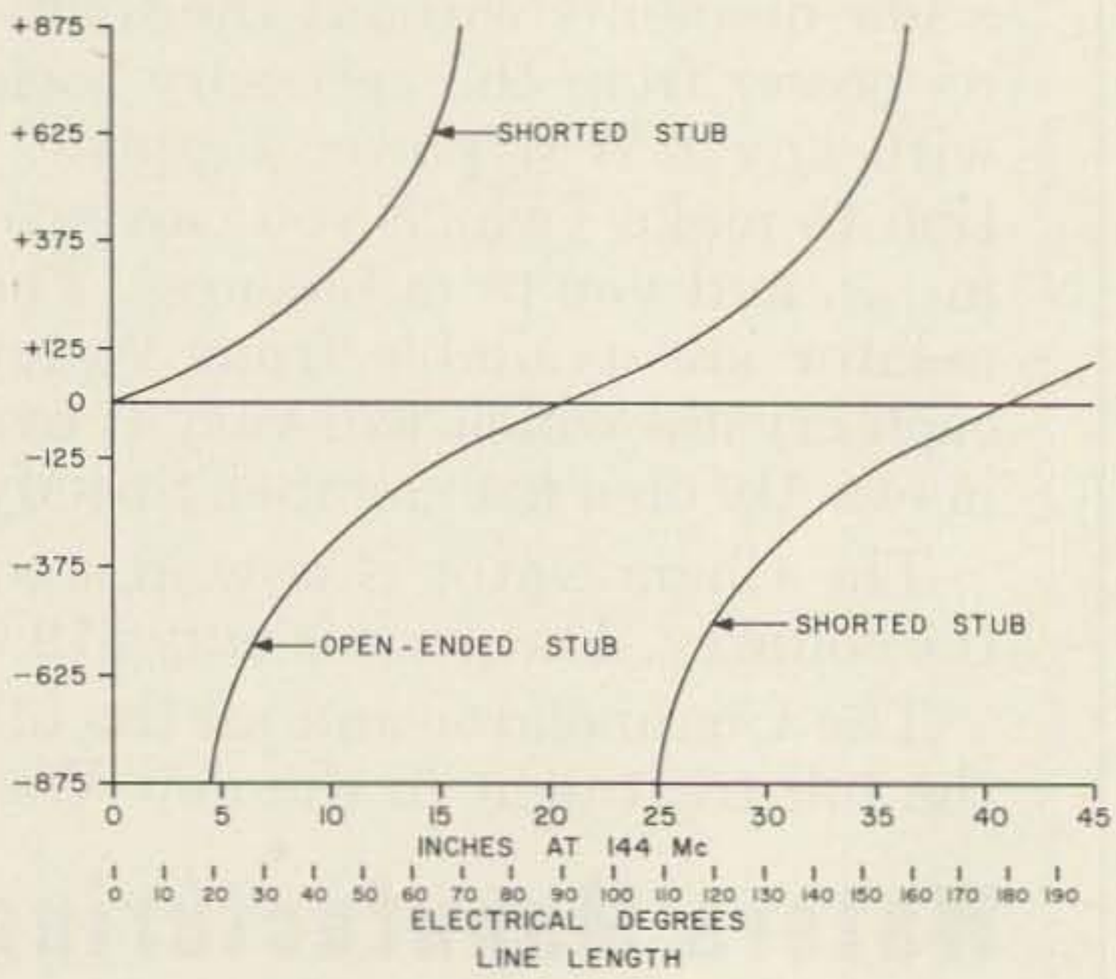


FIGURE 3

as well, but the general picture isn't so hard to see.

Put simply, it's this. If we can introduce a 5.77-to-1 mismatch across a 300-ohm line, there will be a point every half-wavelength along that line at which the effective impedance is 52 ohms of pure resistance. All we have to do is to hook the feedline to the *end* of the matching device as shown in Figure 4 and we're on our way.

The problem of getting the required 5.77-to-1 SWR on a 300-ohm line which is feeding a 300-ohm antenna is a bit more involved; for this, we use the shorting stub, and this is where we have to use a Smith chart for the details (don't let that scare you away—you don't need it in practice). Assuming that we *had* the proper 5.77-to-1 SWR on the 300-ohm line, we would find the line impedance varying from a low of 52 ohms resistive up to a high of 1,731 ohms resistive. In between, the impedance would have both a resistive and a reactive component.

Just for the example, we did use a Smith chart to find out what the reactive component would be at the first point along the line having 300 ohms of resistive component. It's a negative 600 ohms.

Now all we have to do is to supply a positive 600 ohms of pure reactance at the same point to tune out the negative 600, and we have 300 ohms of pure resistance again. Figure 3 tells us that a 14½-inch (at 144 Mc) portion of 300-ohm shorted line will give us the reactance; fortunately, the resistive component of the line is so high that we can consider this to be pure reactance.

The Smith chart also told us how far from the 52-ohm point that 300-j600 ohm point was; the distance is 0.188 wavelengths.

So we connect up as in Figure 4, with the distance from the feedline to the antenna tap measured as 0.188 wavelengths (15-7/16" at 144 Mc) and the distance from antenna tap on down to shorting bar as another 14½ inches, and the job is done. We've achieved a perfect match.

The Smith chart, though, was necessary only to show an example of how this works. In practice it's much easier.

First, try the factory-recommended technique. It works most of the time. But if you can't find a combination of adjustments which gets the SWR down, or if you get a low SWR only with the feedline right up near the antenna connection and the shorting bar anywhere from ⅛ to ⅜ wavelength down from there, then antenna and feedline connections as

VERY HIGH PERFORMANCE COMMUNICATION ANTENNAS

BEAMS High Forward Gain

Rugged, Lightweight, and real performers. Booms 1" aluminum tubing, elements ⅜" aluminum rod preassembled on booms. Reddi Match for direct 52 ohm feed. Add on stacking kits available for dual and quad arrays.

Model A144-11—11 element, 2 meter, boom 12' $12.75
Model A144-7—7 element, 2 meter, boom 8' 8.85
Model A220-11—11 element, 1¼ meter, boom 8.5' 9.95
Model A430-11—11 element, ¾ meter, boom 5' 7.75

6 METER BEAMS: Full size, wide spaced, booms 1¼" and 1½" diameter, elements ¾" diameter aluminum tubing. Reddi Match for direct 52 ohm feed 1:1 SWR.
Model A50-3—5 element, 6 meter, boom 6' $13.95
Model A50-5—5 element, 6 meter, boom 12' 19.50
Model A50-6—6 element, 6 meter, boom 20' 32.50
Model A50-10—10 element, 6 meter, boom 24' 49.50

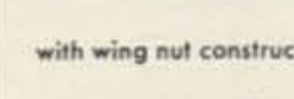
COLINEARS Broad Band Coverage

Ideal all around VHF antennas featuring lightweight, mechanical balance, high power gain, major front lobe, low SWR, low angle or radiation, and large capture area.

Model CL-116—2 meter, 16 element colinear. $16.00
Model CL-216—1¼ meter, 16 element colinear. 12.85
Model CL-416—¾ meter, 16 element colinear. 9.85
Model CL-MS—Universal matching stub matches 300 ohm 16 element antennas to 200, 52, or 72 ohm feed lines 4.75

Add on stacking kits available for 32, 64, and 128 element arrays.

TWIST Another CushCraft 1st!
For Tracking Oscar III



For satellite tracking, back scatter, or point to point communications. The Twist provides either vertical or horizontal and left or right circular polarization. Ideal as a combination point to point or base to vertical mobile antenna. Reddi Match driven elements for direct 52 ohm feed. Cut to frequency within 130 to 150 Mc. range.

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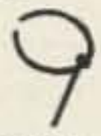
The amazing Big Wheel is a horizontally polarized, broadband, omnidirectional gain antenna. It provides direct 52 ohm coaxial feed.

Model No. ABW-144 Single 2 meter Big Wheel $10.95
Model No. ABW-220 Single 1¼ meter Big Wheel 9.95
Model No. ABW-430 Single ¾ meter Big Wheel 8.95
2 Bay stacking Kits available 3.95
4 Bay stacking Kits available 11.75

MOBILE HALOS: Aluminum construction; machined hardware; Reddi Match for 52 or 72 ohm direct feed. 2 meter. Dual halo two bands one 52 ohm feed line.
Model AM-2M—2 meter, with mast. $8.70
Model AM-22—2 meter, stacked Complete 14.95
Model AM-6M—6 meter, with mast. 12.50
Model AM-26—6 and 2 dual halo, with mast 17.45

NEW ZIPPER PORTABLE BEAMS
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with wing nut construction for sturdy swing out portability, and ZIP assembly.

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shown in Figure 4.

Start with the antenna tap right up at the feedpoint and the shorting bar a quarter-wave farther on. Move the antenna tap for the lowest SWR reading you can get, then adjust the shorting bar to see if you can make it lower yet. When the shorting bar has been readjusted, try moving the antenna tap again. Getting into the right ballpark is easy; reducing the SWR from a 1.1 reading on down to 1.01 can be tedious.

However, don't stop until you can no longer get any flicker of the SWR-meter needle at all. Then you can be sure that you have—for your favorite frequency at least—the perfect match!

. . . K5JKX

Where Have Our Bands Gone?

Wells Chapin W2DUD
118 Woodmancy Lane
Fayetteville, N. Y.

In the beginning around the early 1900's we literally picked a place to transmit on. Things were good—the longer the wave length used the better they thought the results were. You even found a few hams operating around 300 meters. Then suddenly we found ourselves relegated to 150 to 220 meters. This disturbed the gang a little and work was started to get additional space for ham radio. Thus the ham bands were extended with special licenses to wave lengths from 150 meters on down. The famous trans-Atlantic experiments by hams on 100 meters stimulated interest in higher frequencies. The ARRL tests of the higher frequencies followed with the result that it was proved by hams that this new spectrum was indeed quite useful and even gave amazing

Form No. 8 LICENSE NO. 128

UNITED STATES OF AMERICA
FEDERAL RADIO COMMISSION

RADIO STATION LICENSE

CLASS: Amateur CALL SIGNAL 9 D U D

Wells Chapin, is hereby authorized, subject to the provisions of the Radio Act of 1927 and the conditions mentioned in this license, to use and operate the radio apparatus herein described for the transmission of radio communications for a period of ONE YEAR from the date of issuance unless this license is sooner suspended or revoked.

This license shall not vest in the licensee any right to operate the station, nor any right in the use of the frequencies or wave lengths specified herein beyond the terms hereof, nor in any other manner nor at any other time or place than authorized herein. This license is expressly subject in terms to the right of use or control conferred by section 6 of said Radio Act.

The apparatus authorized to be used and operated by the licensee is located in the State of Missouri, county of ..., city or town of St. Louis, Blackstone Place Street, Number 1425, and is described as follows: W-CW-TELEPHONE

This station is authorized for communication only with similarly licensed stations and on wave lengths or frequencies within the following bands:

Meters	Kilocycles	Meters	Kilocycles
0.7477 to 0.7496	401,000 to 400,000	37.5 to 42.8	8,000 to 7,000
4.69 to 5.35	64,000 to 56,000	75.0 to 85.7	4,000 to 3,500
18.7 to 21.4	16,000 to 14,000	150.0 to 200.0	2,000 to 1,500

telephone permitted only in bands 150-200, 20.68-21.4, 4.69-5.35 meters

with a power output of 100 watts,

and at all times unless interference is caused with other radio services, in which event a silent period must be observed between the hours of 8.00 and 10.30 p. m., local time, and on Sundays during local church services.

This station is not authorized to broadcast news, music, lectures, sermons, or any other form of entertainment.

This license is issued under and in accordance with the Radio Act of 1927, and all of the terms and conditions thereof are made a part hereof as though specifically set out in full herein.

Dated this 18th day of Nov., 1927

At Chicago, Ill.

FEDERAL RADIO COMMISSION,
W. H. G. BULLARD, Chairman.
By ..., Supervisor of Radio.

Fig. 1

DEPARTMENT OF COMMERCE
RADIO DIVISION

REVISED U. S. AMATEUR REGULATIONS
Superseding those dated March 6, 1928

An amateur station is a station operated by a person interested in radio technique solely with a personal aim and without pecuniary interest. Amateur licenses will not be issued to stations of other classes.

Amateur radio stations are authorized for communication only with similarly licensed stations, except as indicated below, and on wave lengths or frequencies within the following bands:

Kilocycles	Meters	Kilocycles	Meters
401,000 to 400,000	0.7477 to 0.7496	8,000 to 7,000	37.5 to 42.8
64,000 to 56,000	4.69 to 5.35	4,000 to 3,500	75.0 to 85.7
30,000 to 28,000	9.99 to 10.71	2,000 to 1,500	150.0 to 200.0
16,000 to 14,000	18.70 to 21.40		

and at all times unless interference is caused with other radio services, in which event a silent period must be observed between the hours of 8 p. m. and 10.30 p. m., local time, and on Sundays during local church services.

Amateur radio telephone operation will be permitted only in the following bands:

Kilocycles	Meters
64,000 to 56,000	4.69 to 5.35
3,550 to 3,500	84.50 to 85.70
2,000 to 1,715	150.00 to 175.00

Amateur television and operation of picture transmission apparatus will be permitted only in the following bands:

Kilocycles	Meters
60,000 to 56,000	5.00 to 5.35
2,000 to 1,715	150.00 to 175.00

Spark transmitters will not be authorized for amateur use.

Amateur stations must use circuits loosely coupled to the radiating system or devices that will produce equivalent effects to minimize key impacts, harmonics, and plate supply modulations. Conductive coupling, even through ..., will **not** be permitted, but this restriction shall not apply against the employment of transmission line feeder systems to Hertzian antennae.

Amateur stations are not permitted to communicate with commercial or Government stations unless authorized by the licensing authority except in an emergency or for testing purposes. This restriction does not apply to communication with small pleasure craft such as yachts and motor boats holding limited commercial station licenses which may have difficulty in establishing communication with commercial or Government stations.

Amateur stations are not authorized to broadcast news, music, lectures, sermons, or any form of entertainment, **or to conduct any form of commercial correspondence.**

No person shall operate an amateur station except under and in accordance with an operator's license issued to him by the Secretary of Commerce.

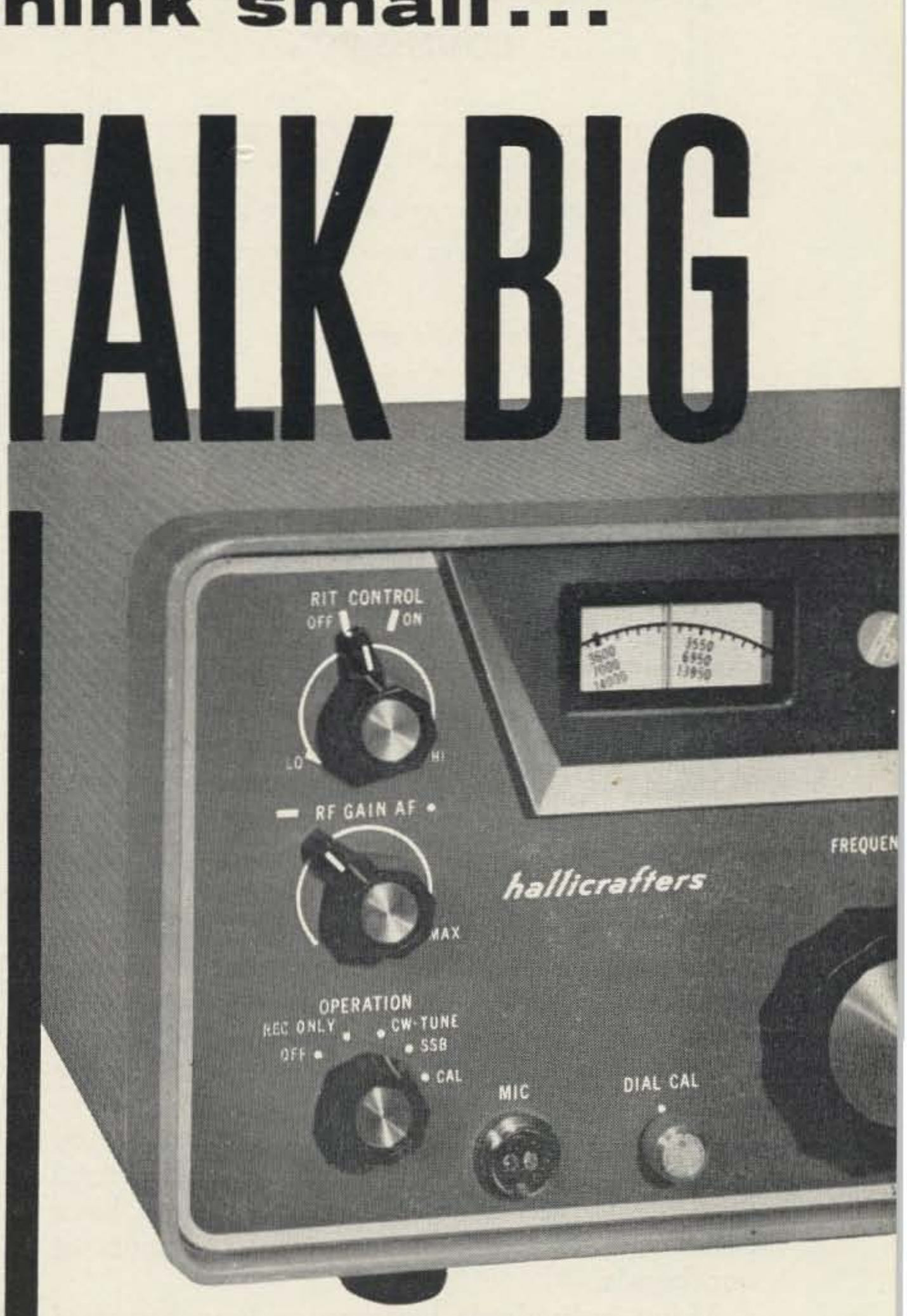
SEPTEMBER 1, 1928.

W. D. TERRELL,
Chief, Radio Division.

Fig. 2

think small*...

TALK BIG



No one but Hallicrafters could shoehorn such sheer, unadulterated **talk power** into so beautifully compact a package as the new SR-160 Tri-band Transceiver. Why Hallicrafters alone? **Eight productive, successful years of SSB and transceiver experience,** leading to such advanced, exclusive techniques as **AALC (Amplified Automatic Level Control)** providing up to 12 db. of effective compression . . . **RIT (Receiver Incremental Tuning)** with ± 3 kc, for superior net and CW operation . . . and a superbly designed **crystal lattice filter** which makes the most of the desirable SSB transmission characteristics. **A built-in changeover relay** permits direct operation with the HT-45 or other linear amplifier. Sensitivity is **less than 1 μv for 20 db.** (yes, 20) S + N/N ratio.

The receiver employs a separate AVC amplifier providing a figure of merit of 100 db. These and a dozen other outstanding features make the new SR-160 your best transceiver buy. Write for complete specifications or see your Hallicrafters distributor today.

* *Small size:* *13" x 6½" x 11"*
Small weight: *Only 13¼ lb.*
Small price: *$349.50 less power supplies and mobile mounting kit.*

NEW SR-160

Tri-band SSB/CW Transceiver

by hallicrafters

Fifth & Kostner Aves. Chicago, Ill. 60624

Export: Hallicrafters International Div. **Canada:** Gould Sales Co., Montreal, P.Q.

FEDERAL COMMUNICATIONS COMMISSION

RULES GOVERNING AMATEUR RADIO OPERATORS AND STATIONS

EFFECTIVE DECEMBER 1

1938

ALLOCATION OF FREQUENCIES

152.25. **Frequencies for exclusive use of amateur stations.**—The following bands of frequencies are allocated exclusively for use by amateur stations:

1715 to 2000 kilocycles.*
3500 to 4000 kilocycles.
7000 to 7300 kilocycles.
14000 to 14400 kilocycles.
28000 to 30000 kilocycles.
56000 to 60000 kilocycles.
112000 to 118000 kilocycles.*
224000 to 230000 kilocycles.*
400000 to 401000 kilocycles.

152.26. **Use of frequencies above 300000 kilocycles.**—The licensee of an amateur station may, subject to change upon further order, operate amateur stations, with any type of emission authorized for amateur stations, on any frequency above 300000 kilocycles without separate licenses therefor.

152.27. **Frequency bands for telephony.**—The following bands of frequencies are allocated for use by amateur stations using radiotelephony, type A–3 emission:

1800 to 2000 kilocycles.
28500 to 30000 kilocycles.
56000 to 60000 kilocycles.
112000 to 118000 kilocycles.*
224000 to 230000 kilocycles.*
400000 to 401000 kilocycles.

*Subject to change to "1750 to 2050" kilocycles in accordance with the "Inter-American Arrangement Covering Radiocommunication," Havana 1937.
*The Commission reserves the right to change or cancel these frequencies without advance notice or hearing.

Fig. 3

results in daylight. This is the period when all our trouble really started. The commercial interests moved in and since that time have been consistently chopping away segments of our bands.

Many individuals have given long hours of their time and at considerable expense in campaigning to save ham radio and our bands. If it had not been for these early hams and the ARRL we would not be here today. Over the years we have consistently lost ground. Why? Let's take a look at some of the official documents of the early period and see where we were and where we stand today. Figure 1 is 1927. It is interesting to note that in 1927 hams in foreign countries were using frequencies in addition to these. For instance: DX was a lot easier—you could work the Australians and New Zealanders across band on 32 to 34 meters. The South Americans were generally between 35 and 36 meters and if you preferred Europe you merely called CQ Europe and looked from 42.8 to 44 meters. This was the DX man's dream—you even knew where to find the country you needed. So the over-all loss of ham bands since 1927 has been substantial. Figure 2 is a page from the FCC regulations of 1928. This is about the time when the ARRL and individual hams finally realized that we were in trouble and fighting for our life. The ARRL and individual hams did an excellent job of promoting ham radio and succeeded in slowing this trend. Analysis of the situation further, you find that since that time, what we have been really doing, is fighting a delaying action. Let's take a look at 1938 in Figure 3. Notice the chopping has begun. Figure 4 shows 1946. Figure 5 is a composite.

It's obvious unless we stop this trend of cutting back our VHF frequencies and moving us toward UHF and EHF, we will, in the near future, be talking on a beam of light and with todays technology maybe that's not such a bad idea.

It would seem, that just like all good negotiators, that for a change we ask for more spectrum than we have and want, so that we have a bargaining position. Perhaps we can reverse this trend or at worst stop this nibbling away

1927 in KC		1938		1946		1963	
1,500	2,000	1,715	2,000	1,750	2,050	1,800	2,000
3,500	4,000	3,500	4,000	3,500	4,000	3,500	4,000
7,000	8,000	7,000	7,300	7,000	7,300	7,000	7,300
14,000	16,000	14,000	14,400	14,000	14,400	14,000	14,350
						21,000	21,450
		28,000	30,000	28,000	29,700	28,000	29,700
56,000	64,000	56,000	60,000	50,000	54,000	50,100	54,000
		112,000	118,000	114,000	148,000	144,000	147,900
		224,000	230,000	235,000	240,000	220,000	225,000
400,000	401,000	400,000	401,000	420,000	450,000	420,000	450,000
				1215 MC	1,295	1215 MC	1,300
				2300 MC	2,450	2300 MC	2,450
						3500 MC	3,700
				5250 MC	5,650	5650 MC	5,925
				10,000 MC	10,500	10,000 MC	10,500 MC
				21,000 MC	22,000	21,000 MC	22,000
						ABOVE	30,000 MC

Fig. 5

FEDERAL COMMUNICATIONS COMMISSION ·

RULES AND REGULATIONS

(TITLE 47 TELECOMMUNICATION CHAPTER I)

PART 12

RULES GOVERNING AMATEUR RADIO SERVICE

EFFECTIVE APRIL 1, 1946

(Revised to May 9, 1946)

(1) *Below 25 mc.*
1750 to 2050 kc.
3500 to 4000 kc.
7000 to 7300 kc.
14,000 to 14,400 kc.
(2) *Above 25 mc.*
28 to 29.7 mc.
50 to 54 mc.
144 to 148 mc.
1215 to 1295 mc.
2300 to 2450 mc.
5250 to 5650 mc.
10,000 to 10,500 mc.
21,000 to 22,000 mc.

(*b*) The band of frequencies 420 to 450 megacycles is allocated for use by amateur stations (and temporarily by other services for special air navigational aids) subject to the limitation of 50 watts peak antenna power.

(*c*) The band of frequencies 235 to 240 megacycles is allocated for use by amateur stations until January 1, 1949; the frequency band 220 to 225 megacycles is allocated for use by amateur stations beginning January 1, 1949.

Fig. 4

at our bands. We can prove our ranks have grown and our bands have shrunk and if that isn't argument enough I haven't seen one. Let's pull out the crying towel—history shows us to be the father of radio. Our work proved this VHF spectrum valuable. Chopping away at our bands is like killing your own father—slowly—and that just isn't cricket these days.

This is the time for all of us to pull together. We need more public relations work. Our leadership must be the most intelligent we can get and in addition aggressive beyond anything that has ever been done before.

. . . W2DUD

FRESH UP WITH 6-UP

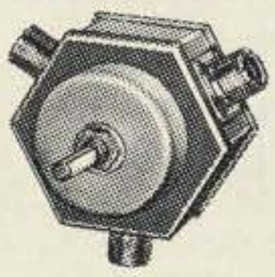
73's new VHF magazine.

$2.00 a year — send name, call, address.
Don't miss it.

6-UP — Peterborough — N. H.

SIMPLIFY
Switching with these
NEW B&W COAXIAL TYPE SWITCHES

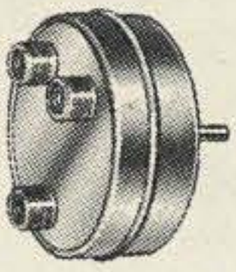
Connectors Mounted on Side



MODEL 550A-2
$7.35 ea.
(Less Dial Plate)

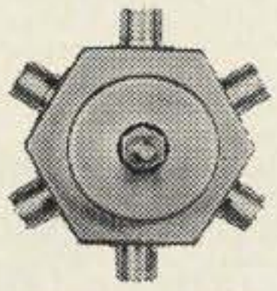
Models 550A-2 and 592 are single pole, 2 position switches with UHF-type connectors.

Connectors Mounted on Back



MODEL 592
$7.35 ea.
(Includes Dial Plate)

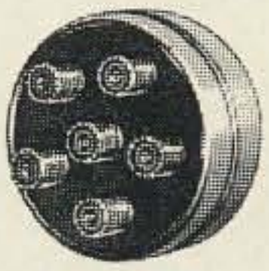
Connectors Mounted on Side



MODEL 550A
$8.25 ea.
(Less Dial Plate)

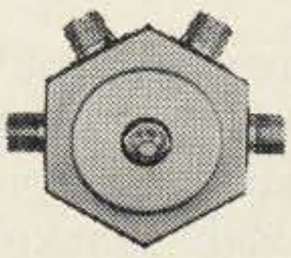
Models 550A and 590 are single pole, 5 position switches with UHF-type connectors.

Connectors Mounted on Back



MODEL 590
$8.25 ea.
(Includes Dial Plate)

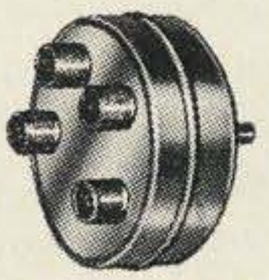
Connectors Mounted on Side



MODEL 551A
$7.95 ea.
(Less Dial Plate)

Models 551A and 591 are 2 pole, 2 position special purpose switches with UHF-type connectors. Designed for switching any RF device in or out of series connection in coax line circuits.

Connectors Mounted on Back



MODEL 591
$7.95 ea.
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PLUS A FULL LINE of single and multiple-gang units with choice of "UHF", "BNC", "N" and Phono-Type connectors (write for literature).

The New Switching Units shown above have the following specifications:

Power Rating: 1KW amplitude modulated, impedance 52-75 ohms—Frequency Range; Audio to 100 MC—Cross Talk; —45 db between adjacent outlets (at 30Mc) —60 db between alternate outlets.

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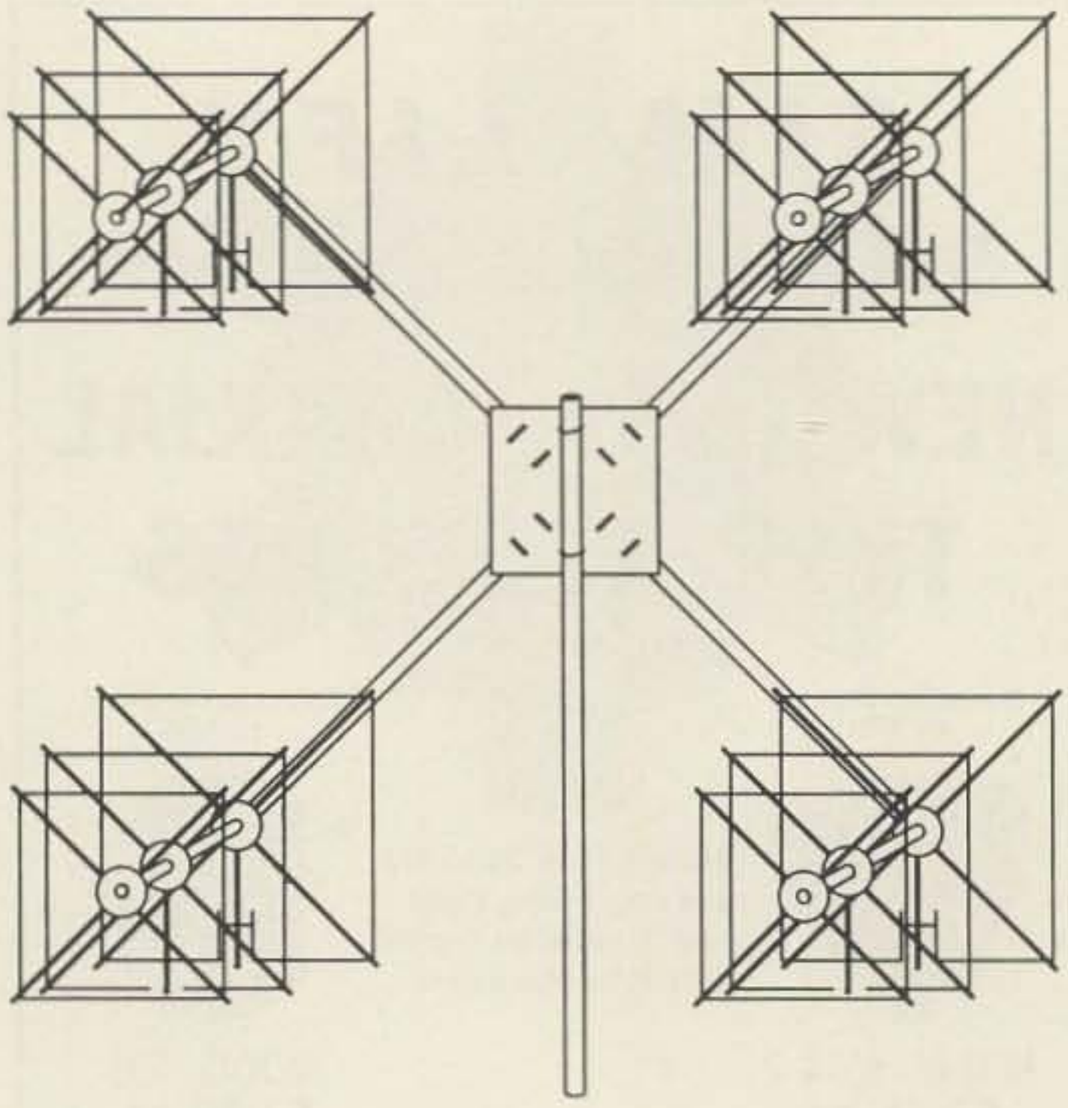


THE Quad-Quad Array for Two

Doug De Maw W8HHS
10598 Peninsula Drive
Traverse City, Michigan

If I were to count the articles written about cubical quad antennas, I would doubtless need a small computer to get an accurate tally. Yet, this antenna is regarded with continued favoritism due to its simplicity of structure, excellent performance and for the availability of the low priced materials which go into its assembly.

Although numerous articles have been published during recent years which related to multi-element quads, nothing has been presented in connection with broadside stacking of these very excellent antennas. The content of this article is the by-product of 2 years of continual experimentation with 2 meter cubical quad configurations. With the help of W8EEF (who is currently using the array described in the text) the end result of this experimentation brought forth an antenna which has outperformed even the best multi-element Yagis and collinear systems against which it was put into competition. The cost of this entire array is something less than $8.00. The forward gain is measured at 15.5 decibels. The front to back ratio exceeds 28 decibels and the front to side ratio is so outstanding that it was virtually immeasurable.

Although the author regards the use of coaxial cable at VHF with something more than casual disfavor, we shall describe the system with the use of a simple coaxial harness and a terminal impedance suitable for use with RG-11/U cable. (UG!) Should the progressive VHFer desire to take advantage of low loss balanced feedline, he will find it necessary to merely add a conventional half wave balum transformer at the feed point of the array. This will convert the unbalanced 75 ohm terminal impedance to a balanced condition for use with 300 ohm open wire or low loss uhf ribbon line. In addition to the many desirable features adready mentioned in this article, the completed array is exceptionally light in weight and exhibits very little wind resistance. It presents a fairly large aperture (capture area) which is of prime importance in receiving at vhf.

The Structure

The framework which supports the 4 three element quads is made from low priced, thin wall, electrical conduit. 1" dia. material was used in the final model but there should be no reason why smaller diameter conduit could not be used. Aluminum tubing, if readily available, would of course make the array much lighter.

The element supports are made from ⅜" dowel rod (available at the local hardware or lumber store), and are either boiled in paraffin wax or weatherproofed by coating them with exterior spar varnish. This will prevent warping and deterioration caused by weather conditions.

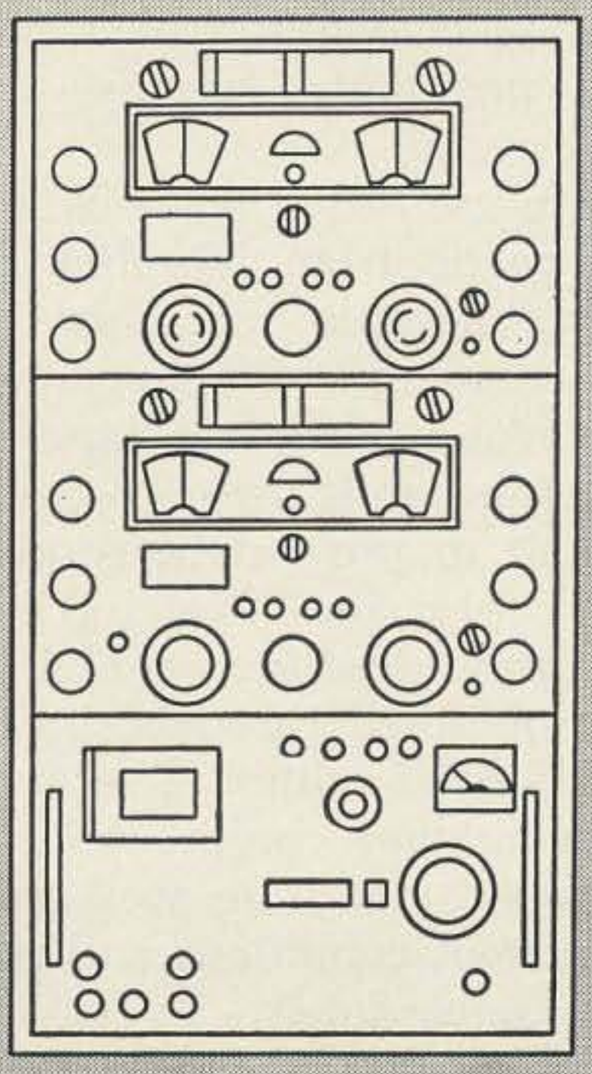
The driven elements, directors and reflectors are made from #10 copper wire which is passed through holes drilled in the outer ends of the wooden dowel rods. The tuning stubs on the reflectors are continuation of the #10

15 KC BANDPASS

OVER THE
.54 TO 31.5 MC
FREQUENCY RANGE

IN THE *New* GPR-91 RXD

COMMUNICATIONS RECEIVER



This new GPR-91RXD Communications Receiver has all of the features — selectivity, sensitivity and reliability — of our GPR-90RXD receiver.

AND IN ADDITION has **15 kc** bandpass for ISB reception of four discrete voice channels or up to 64 teletypewriter channels, when used with our Model SBC-2, Sideband Converter.

Two of these receivers, with common oscillators, such as TMC Model VOX-5, (see line illustration at left) make one of the finest diversity receivers available on the market today.

Our engineering department will be happy to discuss ancillary equipment in our general catalog that may be used with this receiver to fill any of your requirements.

Request TB 3009

THE TECHNICAL MATERIEL CORPORATION MAMARONECK, N. Y.

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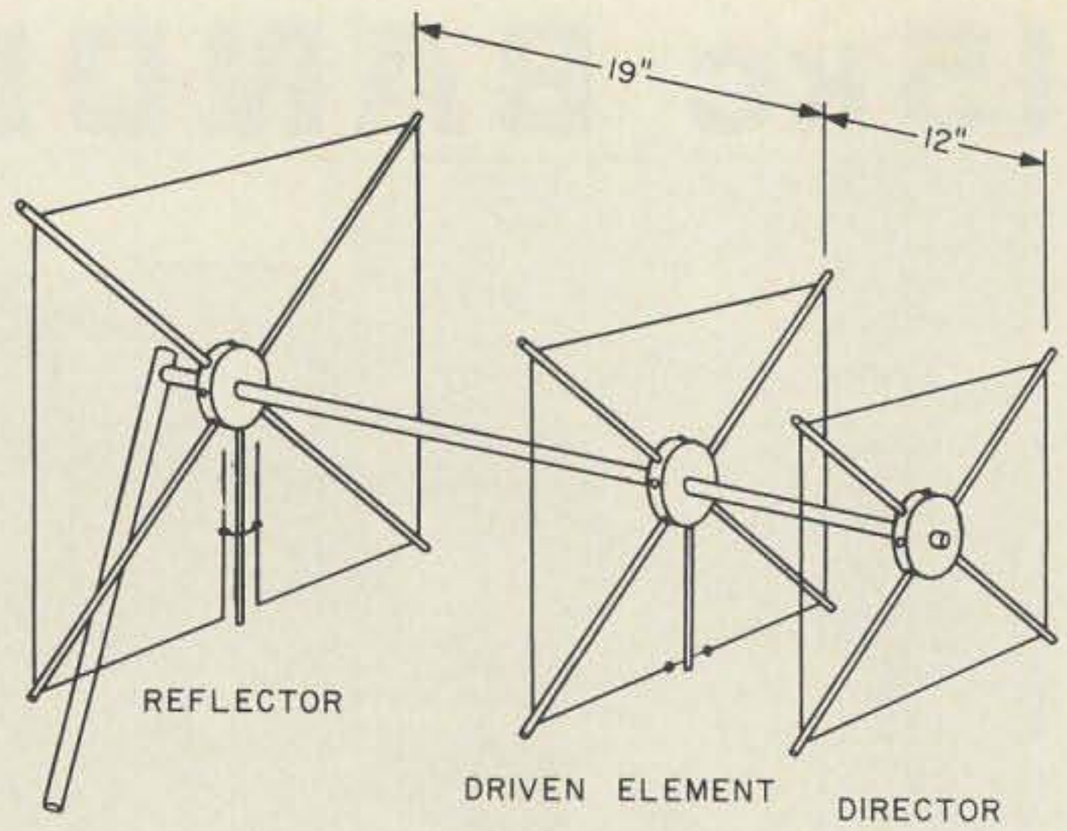
wire used for the reflectors.

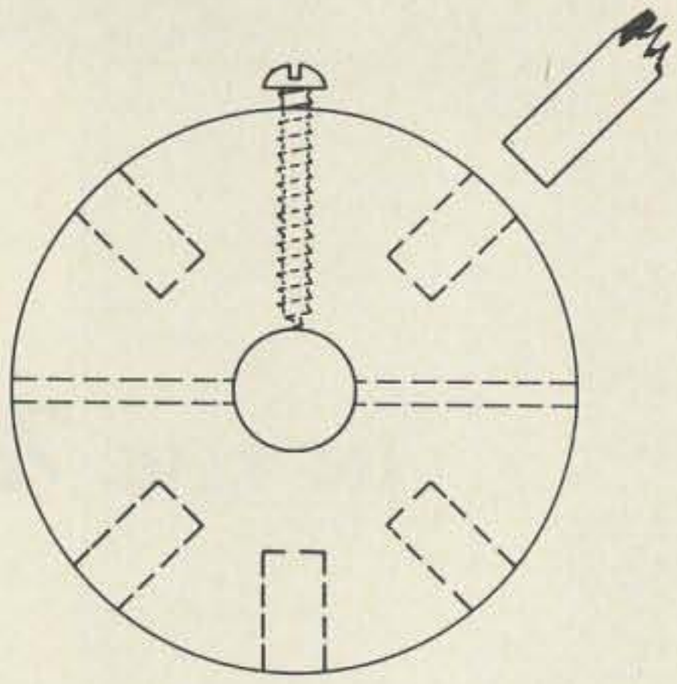
The metal plate located at the center of the framework, which attaches to the antenna mast with U-bolts, is made from ¼" steel plate.

The wooden supporting dowels for each element of the array are glued into wooden center hubs (cut from ¾" plywood with a circle cutter) which are held in place on the ¾" conduit arms with 2 set screws as shown in the illustration. Other methods for fabrication of the supporting assemblies should present themselves after examination of the illustration in the article. However, not being particularly skilled at metal work and with materials being scarce in this area, the method shown was used.

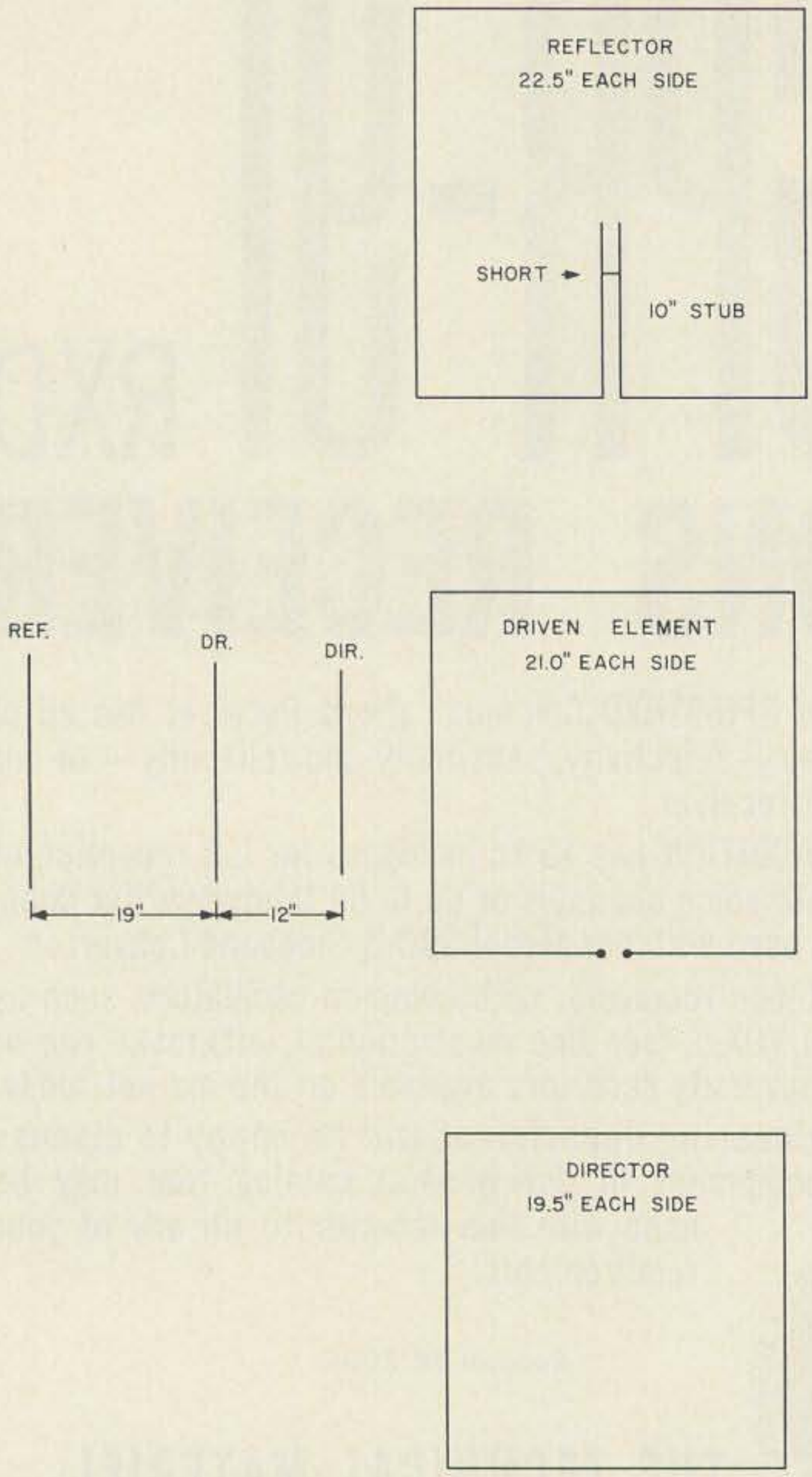


Harnessing

The individual bays are adjusted with the spacing between elements to give a terminal impedance of 75 ohms at 145 mc. The 4 bays are spaced ½ wavelength apart, both vertically and horizontally. Added aperture and possibly slight additional gain could be realized by using full-wave spacing between bays. We did not exploit this possibility because of the added size of the array.



Hub detail
Material
¾" clear pine or plywood
⅜" dowel rod
set screws #6 x 1 ½"
sheet metal screws

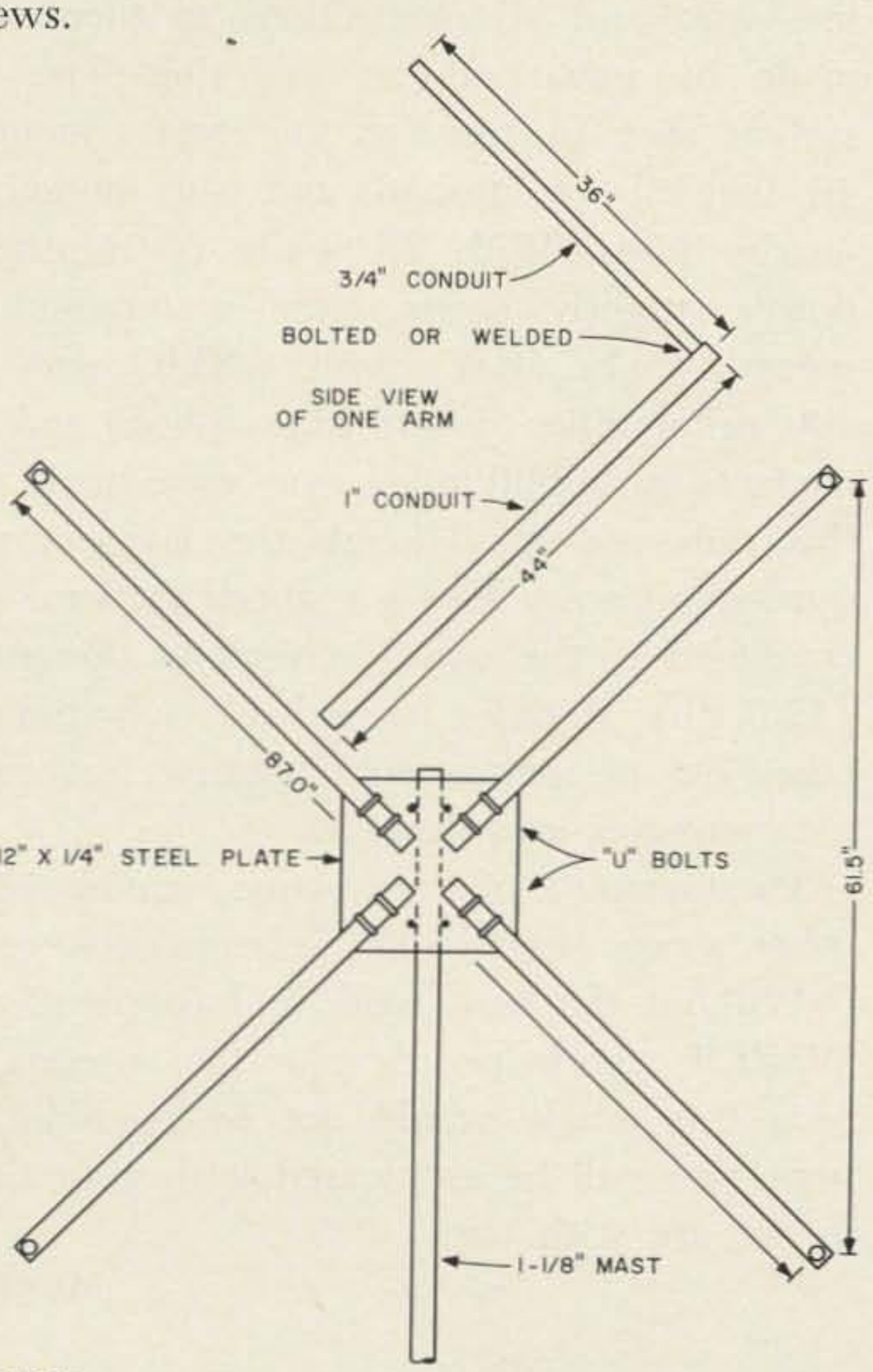


Element data
SWR is 1:1 to 1 over 1 mc
144.5 to 145.5 with these dimensions and spacings.

It is necessary to use 3 quarter wave matching transformers made from 50 ohm coaxial cable during the harness assembly. These pieces are spliced into the 75 ohm sections of line, taped with scotch electrical tape at the points of connection and then coated with epoxy resin cement to prevent moisture from entering the coax cables. RG-59/U and RG-58/U line was used in the described model. Better results would be obtained through the use of RG-11/U and RG-8/U cables. The latter of course are somewhat more bulky. All connections in the harness should be well soldered to prevent intermittent conditions and possible corrosion at some later date.

The harness cables can be held securely in place by either taping them to the supporting

framework or using cable clamps attached to the steel supporting frame with sheet metal screws.



Tune-up After Assembly

Assemble all bays in their respective positions on the supporting framework. Next, attach a suitable length of 75 ohm coax cable temporarily to the feed point of one of the upper bays. Do not attach harness until later! Support the entire antenna structure in such a manner that the bottom 2 bays are at least a wavelength or more above ground and well away from nearby objects. A field strength meter of some type should next be placed 5 or more wavelengths directly in front of the array and preferably 2 or 3 wavelengths above ground. Use a horizontal pick-up antenna on your fs meter. Next, apply transmitter power to the feedline you have attached to the upper bay. While observing the reading on your fs meter (a buddy is handy for this), carefully adjust the shorting strap on the reflector tuning stub for maximum forward power as noted on the meter. Once this point has been located, solder the shorting strap in place.

Antenna support construction
Material:
4 pieces 1" conduit 44" long
4 pieces ¾" conduit 36" long
8 U-bolts for 1" conduit
2 U-bolts for 1⅛" mast
1 12" x 12" x ¼" steel plate

Detroit, Michigan: "Does an excellent job of swinging a 20-40 combination and stacked Finco 6-2 beam."

San Diego, California: "I am well pleased with the rotor to date, holds and turns stacked 40M and up beams in 50 mph winds with no difficulty."

Los Angeles, California: "I have personally installed 3 other HAM-M Rotors in the past 3 years (all of them OK) so I feel that I'm buying the best."

Houston, Texas: "Wonderful! Was using the AR-22 (the CDE TV automatic) and it did a fine job for 4 years, but put up a larger beam and needed more power."

Anchorage, Alaska: "Due to below-zero weather, it took quite a while to get up but the last couple of weeks it has proved perfect. Wish I had one years ago."

Alamo, California: "Works very well and purchased on recommendation of my friend who has been using one for 4 years and likes it quite well."

Swarthmore, Pa.: "Am very pleased with the results. More than meets my expectations."

Pluckemin, New Jersey: "The HAM-M rotates and two TR-15's tilt the 6-foot parabola for 432 and 1296 mc."

Chicago, Illinois: "It really does the job."

New York, N. Y.: "This is a perfect rotor. Can't see where you can improve it."

(a sampling of mash notes received by our HAM-M)

At $119.50 amateur net, the HAM-M is the greatest rotor value around! For technical information, contact Bill Ashby K2TKN. Your local CDE Radiart Distributor has the HAM-M in stock.

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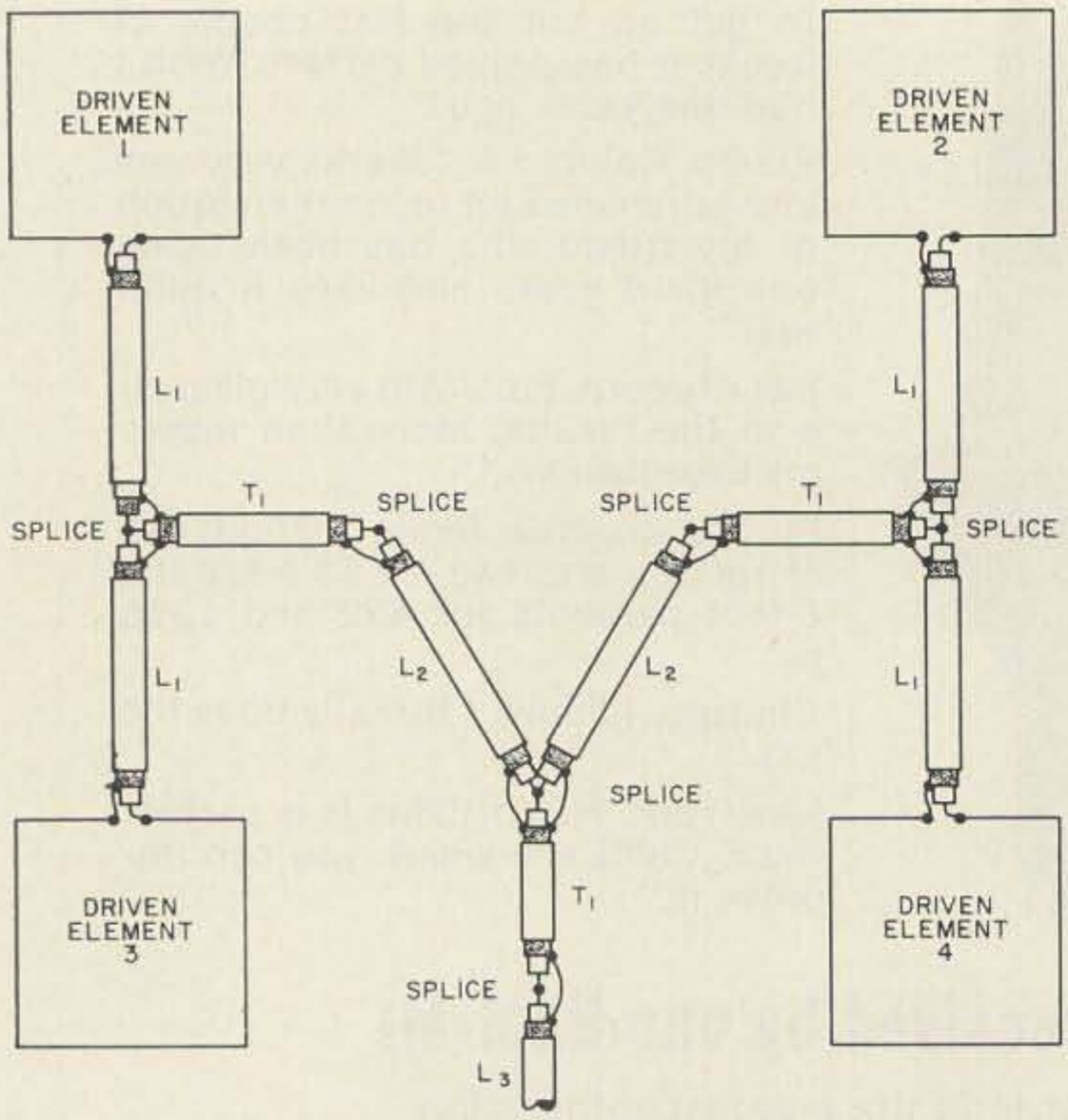

QUAD-QUAD ANTENNA HARNESSING ARRANGEMENT

L—1 RG-11/U, any length (short as possible) but all L-1's must be same length.
L—2 RG-11/U, any length but both must be the same.
T—1 RG-8/U, 12¾" long.
L—3 RG-11/U, any length to transmitter (or through balun to 300 ohm line).

It would be wise to adjust each individual bay in the same manner as we have just described. However, if you do not wish to be this thorough, good results can be secured by carefully measuring the length of the tuning stub from the shorting strap to the reflector, and duplicating this dimension on the other 3 bays. Next, comes the harness installation. Details for this can be found in the illustration showing the harness assembly. A word of caution—make certain that the same polarity is observed on each driven element of each bay, when attaching the harness. In other words, make certain that all coax center conductors attach to the right hand terminal of the driven element and all outer shields attach to the left hand terminals. If you should mistakenly cross phase these bays, serious impairment of the array's performanace would result due to improper phase relationships.

Performance

There are several distinct advantages to be gained through the use of this antenna type. First, the quad-quad array exhibits a diversity effect with regard to polarization. It responds equally well to vertical and horizontal signals. I know there will be some who will disagree with this statement, but observations over the two year period have proven this to be fact. In addition to the polarity convenience, fading on tropo work is far less than with other horizontally polarized arrays. This of course can be attributed to the dual polarity characteristics of the quad array, all of which is advantageous under adverse conditions. Another feature of this antenna system is its excellent back and side rejection. This is especially helpful in congested metropolitan areas where several stations are operating close in frequency and creating cross talk problems etc. Minor lobes are virtually non-existent. This helps in rapid pinpointing of distant signals. The antenna presents a large capture area which is particularly beneficial in receiving. (The larger the capture area, the greater the slice you take from the air and consequently the more signal you will collect on your antenna.)

The first model of this antenna was built and used by the author. It was built on a wooden framework. There were 4 bays but each was comprised of a 2 element quad. The elements were made of heavy duty aluminum clothesline wire and all connections to them were made by using sal-met soldering flux. The system was in use for one year, mounted 40 feet above ground and surrounded by nearby trees. With 25 watts of transmitter power, nightly skeds were maintained for several weeks (CW) with W8YIO who was 190 airline miles distant. Many phone and CW contacts up to 600 miles away were made with this same set-up. Though the less elaborate quad-quad array had a reduced forward gain compared to the one described in this article (12.3 db), it did a remarkable job and was taken out of service only because further experimentation was desired.

By stacking 2 of these arrays, one above the other, a very effective DX antenna could result.

Without the hard work and cooperation of W8EEF, who helped develop this antenna system, this article would not be possible. We hope you will be as pleased with your quads as we are with ours.

. . . W8HHS

SB 33 SET FOR 15

lively, year-round DX band

SB-33 further supports its claim to being the **greatest SSB transceiver value available** by offering an exciting **fourth band,** 15 meters. Sun spot minimums not withstanding, 15 meters is frequently open for coast-to-coast and DX operation, proved this well during the recent phone DX contest by providing "pipe line" channels to South and Central America . . . to Europe from the East Coast . . . to JA, HL, VS1, VK and ZL from the West Coast. This band is ideal for SSB transceiver operation; the major activity being in the 21.25-21.45 mc U.S. phone band thereby allowing **all** stations—DX and otherwise—to be "zeroed".

Fixed or mobile, **SB-33** plays this band like a hot smash off the distant fences! The all-solid-state receiver performs in a manner that must be heard to be believed. Reminder: **SB-33** is **all-solid-state throughout** except for the RF driver and the husky, double PL-500's in the amplifier.

For those who want the **big** signal at modest cost, the **SB1-LA Linear Amplifier.** Delivers 1 KW P.E.P. on 80-40-20, 750 watts P.E.P. on 15.

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Compare **everybody's** transceiver data and prices.
Read all the small print.

	X	Y	Z	SB-33
Four bands: 80-40-20-15				✓
Built-in AC power supply				✓
Built-in speaker				✓
Panel-switchable sidebands				✓
Price . . complete as above				**389.50**

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Please send full information on SB1-LA Linear and SB-33 Transceiver.

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Introducing a new type of audio circuit for Transistors

The Class D Amplifier

Jim Kyle K5JKX
1236 N.E. 44th St.
Oklahoma City 11, Okla.

Long-time readers of these pages will recall that from time to time we have latched onto the latest circuit developments from other countries, working on the theory that a good idea knows no national boundaries.

Well, they've done it again. Our British cousins have developed a new type of audio circuit, specifically for use with transistors, which allows efficiency comparable to that you'd expect to find in a Class C rf stage!

Since it *is* so different from the conventional three classes of amplifiers, they've dubbed it "Class D" operation. Unlike the conventional three classes of amplifiers, Class D depends on *power* relationships rather than voltages.

Before we get into the details of just what it is and how it works, let's look at the "black box" operating characteristics of Class D amplifier. Like a conventional Class A, it draws the same total current from the supply throughout the audio cycle. However, like a Class C, the active devices inside (the output transistors, in other words) dissipate only a small percentage of the power drawn from the supply. Something like 99 percent of the power shows up at the output terminals! Input drive requirements can be as little as you like.

How all this comes is a bit complicated, though. Let's start by abandoning the concept of a transistor as being a gadget "just like a tube only a little bit different" and look at it as another type of animal—a current-controlled switch!

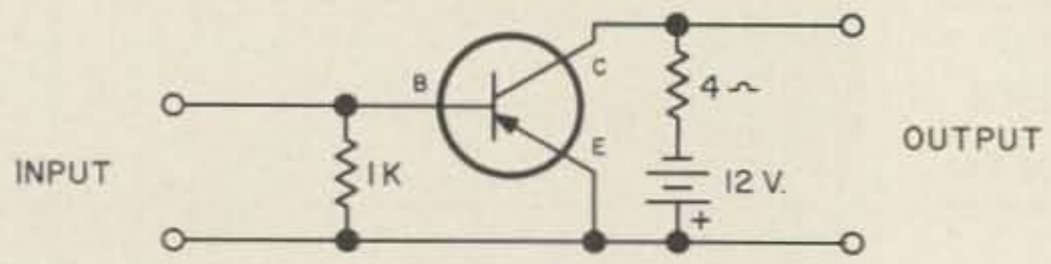

FIGURE 1

If we hook up a transistor according to the schematic in Fig. 1 and leave the input terminal floating, we will find almost the full supply voltage present at the output terminal. With no base current being supplied, the transistor is a pretty good approximation to an open circuit.

But if we now shove, say, one milliamp of current into the base (a flashlight cell in series with a 1500-ohm resistor is a one-mil current supply) we will find almost no voltage at all present at the output. The transistor is now biased to full conduction, and its resistance between collector and emitter is a small fraction of one ohm.

You can see that we are completely ignoring the usually used "linear" portion of the transistor's characteristics, and operating either at cut-off or at saturation.

Now let's look at what's happening inside the transistor so far as power consumption is concerned, when we operate in this way. The (purely hypothetical) pure curve of Fig. 2 will help to examine this.

With no base current and the "switch" open," the collector-to-emitter voltage is virtually equal to the supply voltage. This is point 0 on Fig. 2. You can see that almost no current flows through the transistor, so the internal power dissipation (being equal to C-E voltage times C-E current) is vanishingly small.

With full base current the "switch" is "closed" and current flow is limited only by the series load resistor. We have assumed for the purpose of Fig. 2 that this value is 4 ohms in our example. With a 12-volt supply, 4 ohms

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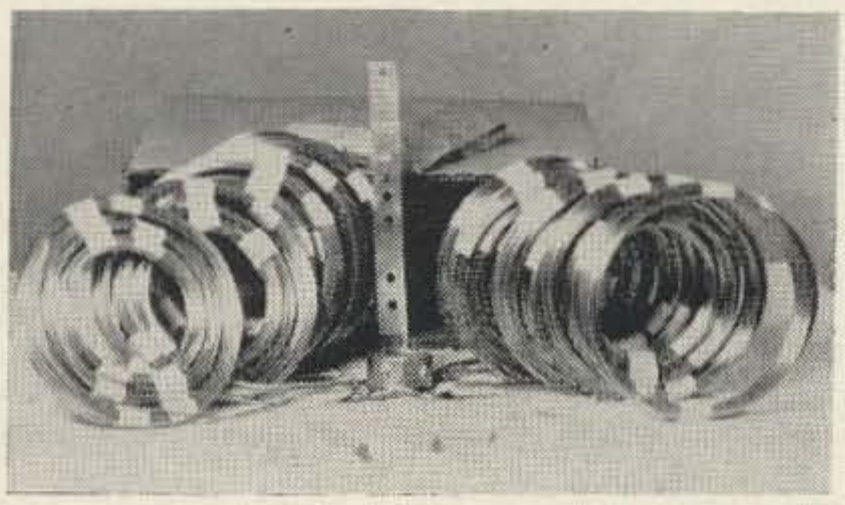

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will allow 3 amperes to flow. The voltage from collector to emitter is almost zero; the transistor operates at point C. Again, however, the internal power dissipation is vanishingly small.

During the brief instants when the switch is turning on or off, the transistor operating point will shift from 0 to C along the dotted line, which is a load line for a 4 ohm resistor. The solid curved line represents a power dissipation of 1 watt; you can see that, while internal power dissipation is almost zero at each end of the load line, it becomes quite high during the transition periods between "on" and "off." However, since the transistor makes the trip from 0 to C or vice versa in a matter of only a very few microseconds, this does no damage.

Fig. 2 has one more point for us—when the switch is *closed* we are dissipating power, but this power is used in the load resistor rather than in the transistor itself.

Now assume that we send a regular series of pulses, a perfect square wave to current, to the input terminal of our switch. We could expect to get a regular square wave out. If we placed a DC ammeter in the supply lead, we would read *not* 3 amps but instead 1½ amps of current—actually, half the time 3 amps would be flowing and the other half of the time the current would be zero. The voltage, likewise, drops to half. The load resistor would be dissipating 1½ times 6, or 9 watts; the transistor would, as always, just be loafing along powerwise.

All of which, you may say, is very fine but what does it have to do with an audio amplifier, Class D or otherwise? Actually, this concept of the transistor as a switch is the heart of the Class D circuit. As shown in the previous paragraph, the transistor just loafs along even though the load is consuming 9 watts of power. What we are talking about is 99 percent efficiency; all we must do now is find a way to use this trick in an audio amplifier.

To see how this is done, let's back away

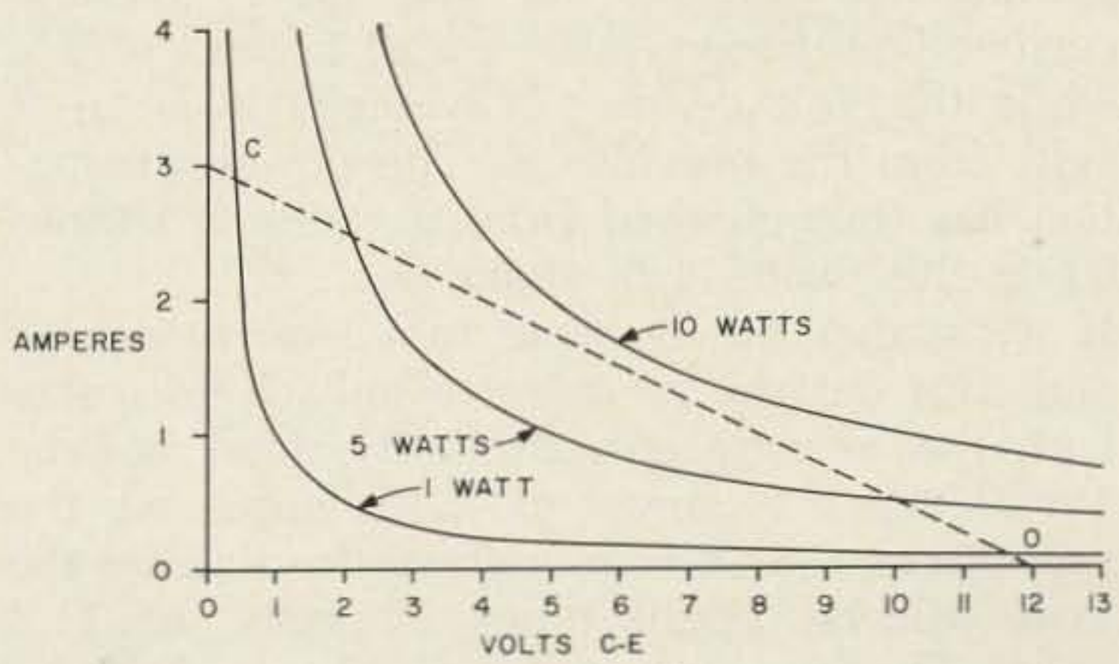

FIGURE 2
Switch curve.

for a moment and consider the vacuum-tube Class B amplifier. This gadget, also, is a switching amplifier—though few of us consider it in that light. Still, only one of the two tubes works at a time. For half the cycle one tube operates and the other rests, then on the other half-cycle their roles are reversed.

This comparison provided the clue but not the complete answer. After all, the vacuum tube Class B amplifier is working as a linear amplifier when it's working. Our transistor switch is either *on* or *off*, with no in-between.

It's almost impossible to give proper credit to the inventor, since so many people in Britain are working with this basic type of circuit. But someone with a flash of genuis happened to look at the theory of pulse modulation while realizing that audio is *power* rather than either current or voltage alone. From there it was a simple step to the idea of pulsing our transistor switch at a supersonic rate, and varying the width of each pulse in direct proportion to the audio power present at the amplifier input.

This produces, at the output of our switch, a string of supersonic pulses whose width (and resulting individual power content) is determined by the input signal. To go back to our example in Fig. 2, let's assume that our square wave of current has a frequency of 50 kc. This makes the switch be *on* for 10 microseconds and then *off* for the next 10 microseconds. The total length of time for one cycle of the square wave (on time plus off time) is 20 microseconds. The equal *on* and *off* times result in 9 watts being dissipated in the load resistor.

Now if we can vary the makeup of the square wave to make the *on* time longer and the *off* time shorter, with their total still 20 microseconds, we can change the amount of power dissipated in the load. For instance, if we lengthen the *on* time to 15 microseconds and cut the *off* time back to 5, the load will be dissipating 3 amps for ¾ of the time and nothing for the rest of the time. Average current flow becomes 2¼ amps, instead of 1½, while the voltage drop (average) rises to 9 volts from the previous 6. The power dissipation has thus climbed from 9 watts (1½ times 6) to 20¼ watts (2¼ times 9).

If we widen the *on* time to 19 microseconds and thus cut the *off* time to only 1 microsecond, the average current in the load will be 19/20 times 3 amps, or 2.85 amps. At the same time, the average voltage drop across the load will be 19/20 times 12 volts, or 11.4 volts. The average power in the load under these conditions is 2.85 times 11.4, or 22.49 watts.

Similarly, we can reduce the *on* time and lengthen the *off* time to reduce the average power in the load. By now you probably have the picture, so we'll only run this calculation for the extreme 1-microsecond-on, 19-microseconds off, case. Under this condition, average current in the load is 1/20 of 3, or .15 amp, while voltage is 1/20 of 12, or .6 volt. Resulting average power is 0.09 watt. Thus we can start with a perfectly square wave and produce 9 watts in the load, and by varying the proportions of *on* and *off* time in the wave have anything from 0.09 watt to 22.49 watts in the load circuit.

As we mentioned earlier, this square wave (we should say pulse wave, since it is square *only* at one operating point) is at a supersonic frequency, so we can't hear it. But if we vary the width of individual cycles at an audio rate, the power in the load will also vary at an audio rate—and this variation in power will come through to our ears loud and clear. Our ears act as low-pass filters cutting off somewhere above 10 kc, and the pulse wave itself makes no difference.

However, if you keep dogs (who *can* hear the 50 kc signal) or if you intend to use a Class D circuit as a modulator (we'll get into this a little later) it would be a good idea to put an additional low-pass filter at the output of the amplifier, just to make sure the pulse wave doesn't get out and cause trouble.

At this point, we have a working Class D circuit—except that we blithely said before that we varied the pulse width at an audio rate, and didn't mention *how* we do this. Anything that will give us pulse-width modulation will work, but in the interests of keeping things as simple as possible let's look at one specific hookup which is ideal for transistor use.

First, of course, we must generate our 50 kc square wave. Instead of making it square to start with, let's make it a sawtooth. Then let's feed it into a Schmitt trigger hookup set to fire at half the sawtooth peak voltage, to square it off.

The reason for doing it this way instead of making it square to start with is that we can now feed our audio wave into the Schmitt trigger at the same time and automatically vary the firing point to vary the proportions of the pulse wave. Fig. 3 shows how this works.

To start with, let's examine it with just the sawtooth present. Things always have more meaning with numbers, so let's assume that our sawtooth is 10 volts high at its peak, and the Schmitt is set to fire at 5 volts. Since we're using a 50 kc sawtooth, it will take 20 microseconds to climb from 0 volts to 10 volts, and

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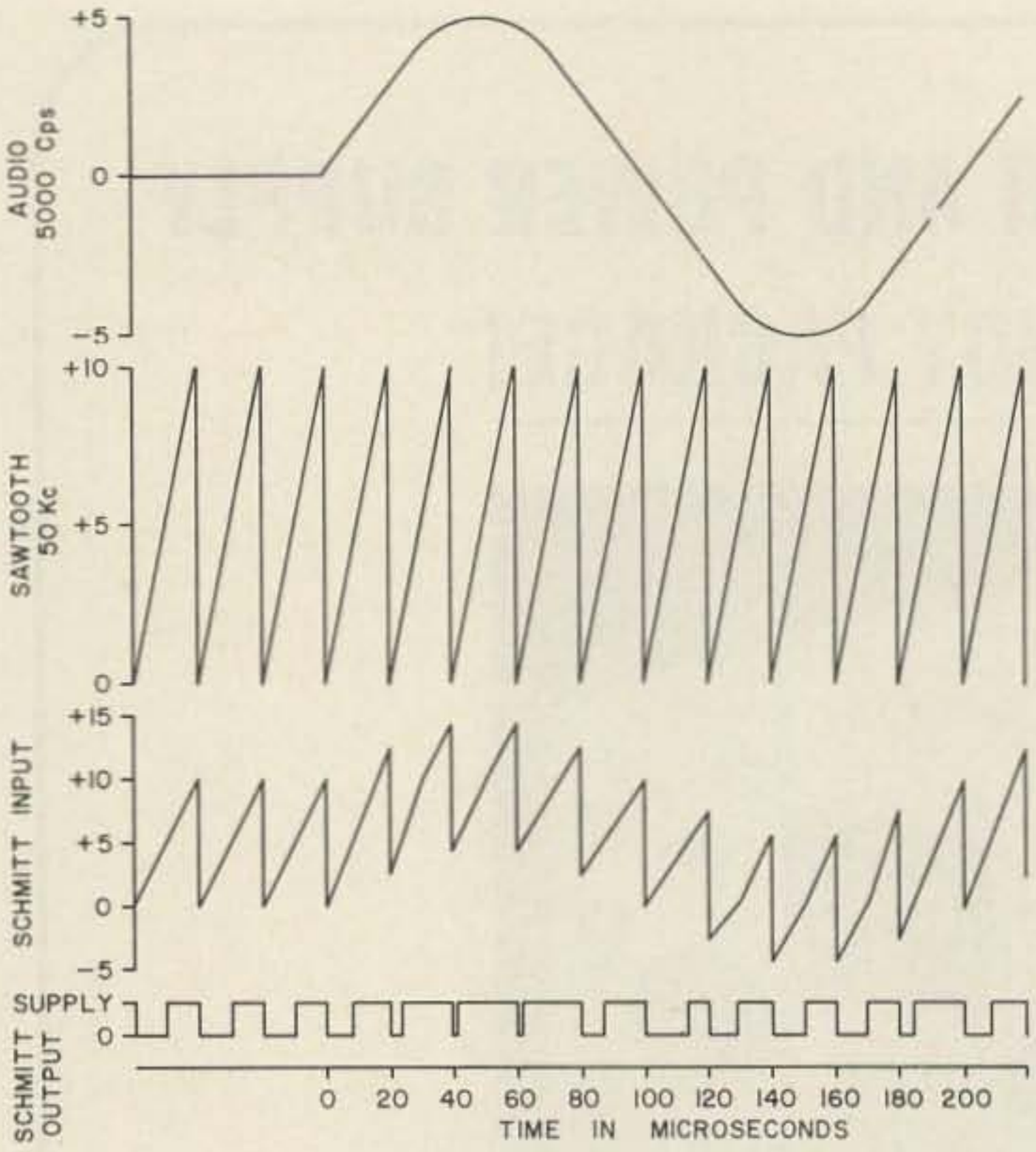

FIGURE 3

Varying the pulse wave.

then it drops back to 0 volts. In the figure, the vertical scales are all in voltage while the horizontal scale is in time.

As the sawtooth starts from 0, the Schmitt sits at 0 input and its output is similarly 0. (The Schmitt, in case you didn't recognize it, is nothing but a pair of switches hooked up so that each one turns the other one off.) After 10 microseconds, the sawtooth voltage has risen to 5 and the Schmitt turns on, bringing its output voltage up to the supply-voltage level. As time passes, the sawtooth keeps rising but since the Schmitt is already turned on it makes no difference. At 20 microseconds, the sawtooth falls to zero and as it passes through 5 volts on the way down, the Schmitt turns off and its output drops to zero also. From here, the cycle repeats. You can see that the Schmitt is *on* for 10 microseconds and then *off* for the next 10, and so forth.

Now let's see what happens when we add a 5 kc sine wave to the input. Just to make it simple, let's make this wave the same peak-to-peak voltage as our sawtooth, or 10 volts.

Starting as the sine wave crosses the zero point, the input to the Schmitt will also be zero since the sum of the sine and sawtooth waves is zero. The sine wave is rising toward its 5 volt positive peak at the rate of 0.14695 volts per microsecond at this point (the first 10

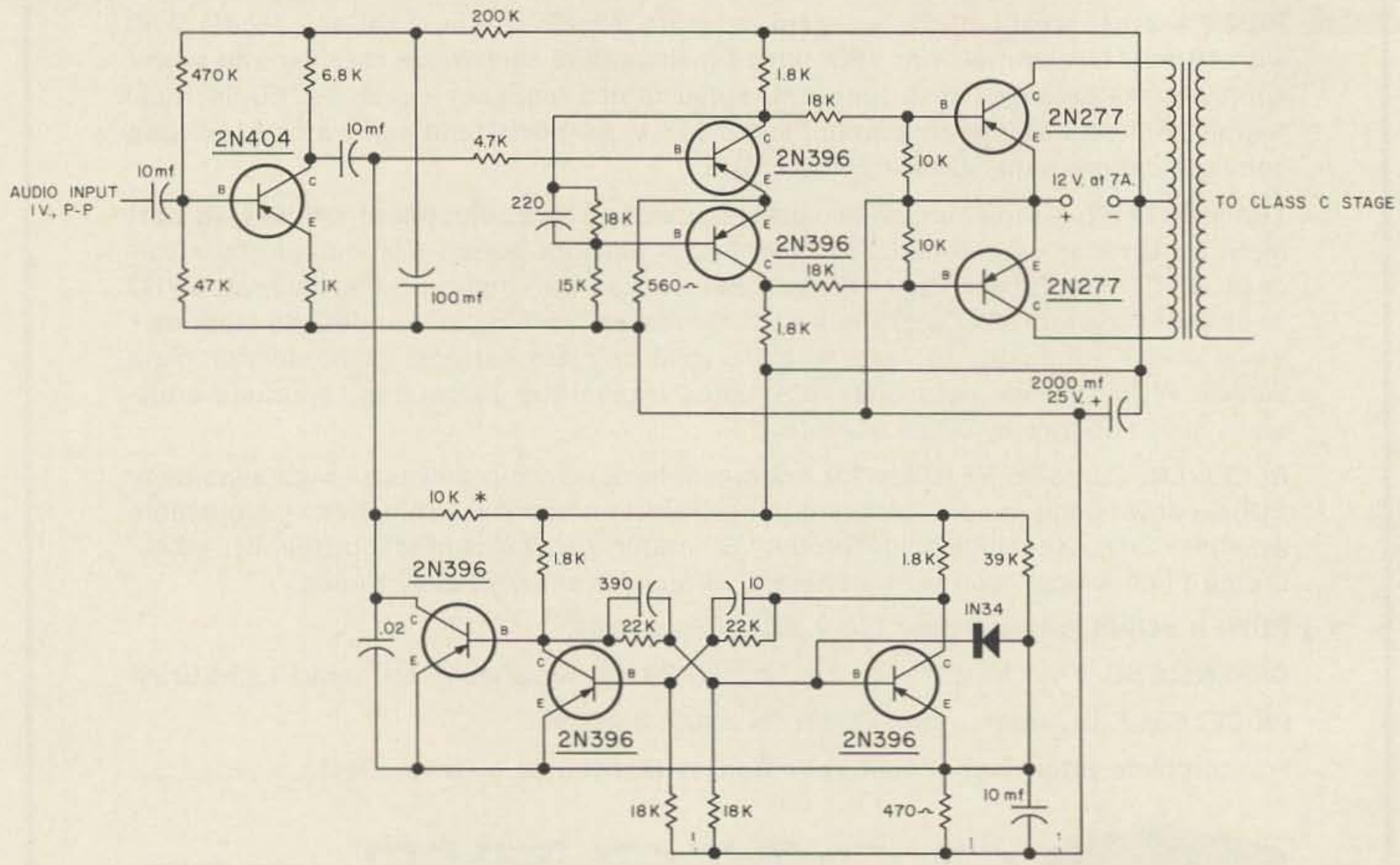

FIGURE 4

Experimental 70 watt class D modulator. Modulator transformer: primary to handle 3 amps, 4 ohms dc resistance (each half)—secondary to suit. Either side of supply may be grounded. Adjust value of 10 K resistor for square wave at bases of 2N277's with no audio. Adjust 390 mmfd capacitor if necessary for 50 kc square wave frequency.

microseconds represent 18 degrees, and the voltage at the end of this time would be 5 times sin 18, so the rate in volts per microsecond is 1/10 of this or 0.14695) while the sawtooth is climbing at ½ volt per microsecond. At any given time the Schmitt input voltage is the sum of these two, so that we can add the two rates together and divide into 5 to find out when the combined wave will reach 5 volts and turn the Schmitt on. The more-or-less exact time when this happens is 7.72859 microseconds after the zero point.

From this 7¾ (approximately) microsecond point the Schmitt remains on until turned off when the sawtooth falls back to zero at 20 microseconds. For this cycle of pulse wave, the *off* time was 7¾ mircoseconds while the *on* time was 12¼ microseconds.

Starting point for the next cycle finds the sine wave at 2.389 volts (it is 36 degrees from zero, so the voltage is 5 times sin 36) while the sawtooth is at zero. Going through the same procedure of determining the rise rates, we find that the sum of the two waves will pass through the 5 volt point 4.03586 microseconds later and turn the Schmitt *on*, where it will remain until the sawtooth next falls to zero.

So during this second cycle of pulse wave, the *off* time fell to 4 1/32 microseconds while the *on* time rose to 15 31/32 microseconds.

We won't go all the way through the cycle this way since the figures get extremely complicated near the peaks of the sine wave and you undoubtedly see how it works by this point. On the negative going half-cycles of audio it works the same way except that, since the sign of the audio voltage is reversed, the difference between the two waveforms rather than their sums determines when the Schmitt fires. Thus the *off* time will increase while the *on* time decreases.

At this point someone is sure to ask "Why not use the Schmitt itself as the output stage? It's a switch, you said." And the answer is that it can be used if you want to keep things as simple as possible.

However, the real beauty of this type of amplification over all the more-conventional classes is that, once you have converted the audio to a modulated pulse train, you can boost it on up to any level you want with a series of switches! A typical Schmitt, designed for fastest possible switching (we have to keep that transition time short, remember, to stay out of the high-power-dissipation regions with our power transistors) will switch maybe 5 watts on and off. It can *control* a switch which is handling 500 watts! This one, in turn, can

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control a 50 kilowatt switch. And so forth. For an extremely low-power amplifier, Class D is hardly worth the trouble of putting together the pulse modulator. But for moderate or high power, it drastically simplifies the circuitry.

Now that we've gone through the Class D amplifier to see how it works, you'll probably want some practical how-to-build-it information. As this is written there has been no opportunity to build and de-bug a circuit, but the design of Fig. 4 is offered as a starting point for any interested experimenter.

The eagle-eyed among you will note several differences between Fig. 4 and the example circuits mentioned earlier. The most obvious, and the most major, is that it uses push-pull switches driven from the two halves of the Schmitt, instead of a single switch.

Using switches in push-pull as shown here doesn't have all the advantages associated with tubes in push-pull, but does have one great advantage—current through the total transformer primary will always be the same. When one switch is on, the other is off, so current in one side will be maximum when the other side is minimum. But averaged over an audio cycle, the average current in both sides is equal; it also happens to be equal to the no-signal current, giving the circuit its similarity to a Class A circuit in this respect.

No low-pass filter is shown, although the circuit is intended as a modulator. This is due to the transformer used, a common 115 volt filament job. A transformer of this type is a pretty good low-pass filter in itself, at 50 kc. Should any 50 kc energy get out and give you spurious sidebands at 50 kc intervals from your carrier frequency, add an rf choke between modulator and final, with a capacitor to ground large enough to bypass the 50 kc without hurting your 3 kc audio limit.

Audio input level isn't especially critical, but it should not be allowed to exceed the peak level of the sawtooth (which in this circuit is about 10 volts). If it does, you'll get a clipping effect since the sawtooth voltage is used to turn the switches *off* every cycle!

For additional data on this type of circuit, try the writings of D. R. Birt and K. C. Johnson in *Wireless World.* In addition, an article by George F. Cooper in the June 1963 issue of *Audio* (published by Radio Magazines, Inc., Mineola, N. Y.) discusses the circuit as it applies to high-fidelity amplifier design. For other approaches to trigger circuits and transistor switch design, try the *G-E Transistor Manual* and Howard W. Sams' *Transistor Circuit Manual* by Allan Lytel. But for the best information on the subject, try it yourself!

. . . K5JKX

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Vladimir Gercke K6BIJ
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Dynamotors in a mobile operation are things of the past. With their 30% efficiency, commutator arcing and mechanical inertia, they cannot compete with transistorized power supplies.

However only a 30-40 watt rig can be operated from a 6 volt battery. It is possible to build a higher power transistorized supply, but buying a 12 volt car is cheaper.

The following two circuits designed to provide 12 volts from a 6 volt car system were built and tested. Both require no changes in your present electrical system other than inserting one resistor.

In the first one (Fig. 1) the value of resistor R1 is chosen so that a voltage drop across it is 6 volts with charging current to the battery held constant and reduced about 50%. This will make available 12 volts at the "A" terminal of the generator. A typical case with a 30 amp generator will look like this: the generator is producing its normal 30 amps, but the voltage at "A" is now 12 volts instead of normal 8 because the field coil has 12v/3 amps across it instead of usual 8v/2 amps. The 12 volt output is split in two equal parts—15 amp is available for your 12 volt load (180 watts), and the other 15 amps are dropped by R1 to 6 volts and are used to charge the battery. Your voltage regulator MAX current contacts are adjusted to open at 15 amps instead of 30, and their action will keep the generator output constant at various engine speeds.

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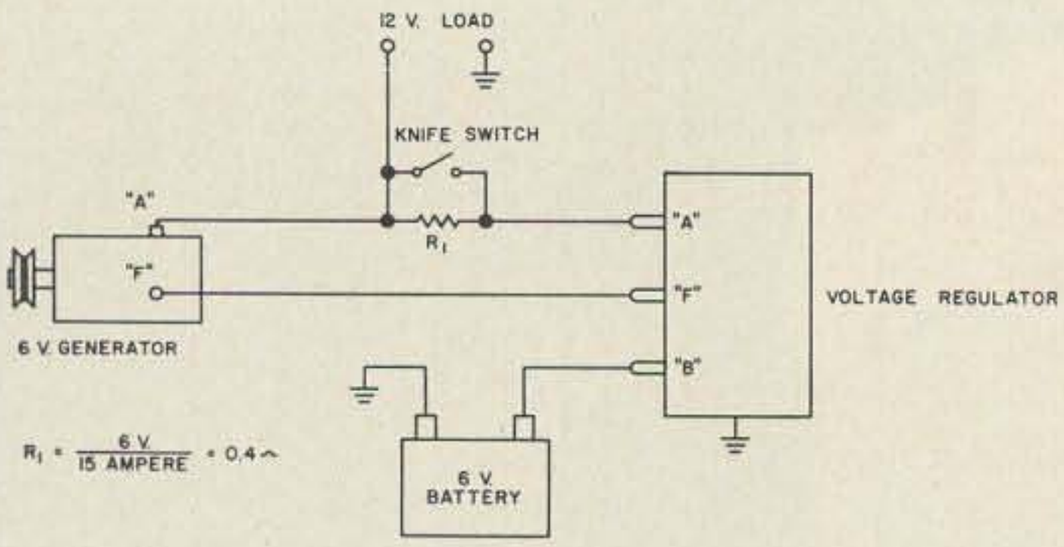

FIGURE 1

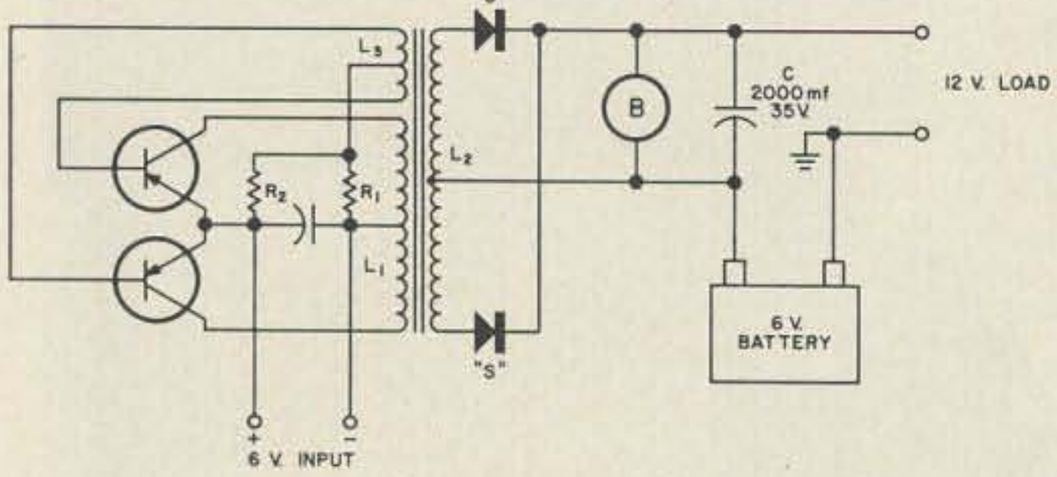

FIGURE 2

See TRIAD brochure TY-61 for components not shown here.

the desert, it seems to be perfectly safe. When 12 volts are not needed, switch SW is closed and the system returns to normal, except that the maximum charging current is now 15 amps (10 ohms across "F" and GND on your regulator will restore it to 30 if necessary).

A word of caution—open R1 will result in a burned out generator, better use a 150-200 watt resistor.

Second circuit (Fig. 2) makes use of an ordinary transistorized dc to dc converter. Both input and output are 6 volts, the output is simply connected in series with the car battery providing 12 volt output for the load.

No transformers are available commercially but they can be easily wound at home. No calculations are necessary—you just pick up any 100 watt 60 cycle transformer that has a 6 volt winding on it and remove all wire, counting the number of turns on the six volt winding only. Using the heaviest wire possible, wind two identical centertapped windings using the same number of turns *each side of centertap* as the original 6 volt winding had. These windings will be I1 and L2. L3 is same as L2/L3, but uses thin wire about 28 to 30 gauge.

"B" is a 12 volt light bulb. It serves as a bleeder passing about one ampere and doubles as an indicating light showing the presence of an output.

The 6 volt, 12 amp output (72 watts) in series with your car battery will provide 140 watts of 12 volts output to the load. "S" are silicon stud rectifiers rated 50 PIV at 15 or more amps. Do not use selenium units as the voltage drop across them is too high. Transistors are the same as you would use for a regular 6 volt transistorized power supply delivering the same wattage output. Triad brochure TY-61 will help you select them as well as other component values for your circuit.

The same ideas can be used to get 24 volts out of a 12 volt car electrical plant.

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Jim Kyle K5JKX
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The schematic may look a bit odd at first, but here's what we have: Forgetting the suppressor and plate and considering only the cathode, grid, and screen, we find a conventional Miller crystal oscillator. This circuit works with either fundamental or overtone rocks, and will give good output as high as 50 mc or more with third-overtone crystals.

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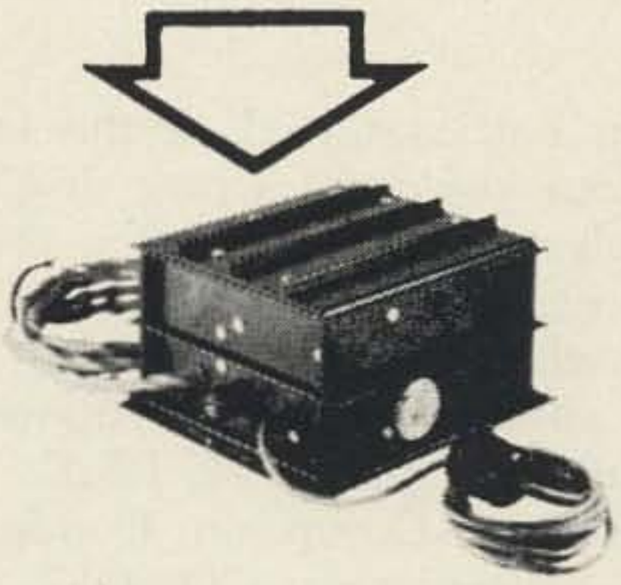

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electron coupling, we have separated the crystal and plate circuits sufficiently that the plate tank may run straight through, double, triple, or even quadruple. And by using a 50 mc overtone rock to start, then quadrupling in the plate circuit, we come out at 200 mc from the single tube.

For some examples of the circuit's usefulness, a 6U8's pentode half can be used with a 45.667 mc crystal to get 137-mc output from the tripling plate circuit; this will be adequate to run a 144 mc to 7 mc converter, leaving the triode half of the tube free to use as a mixer.

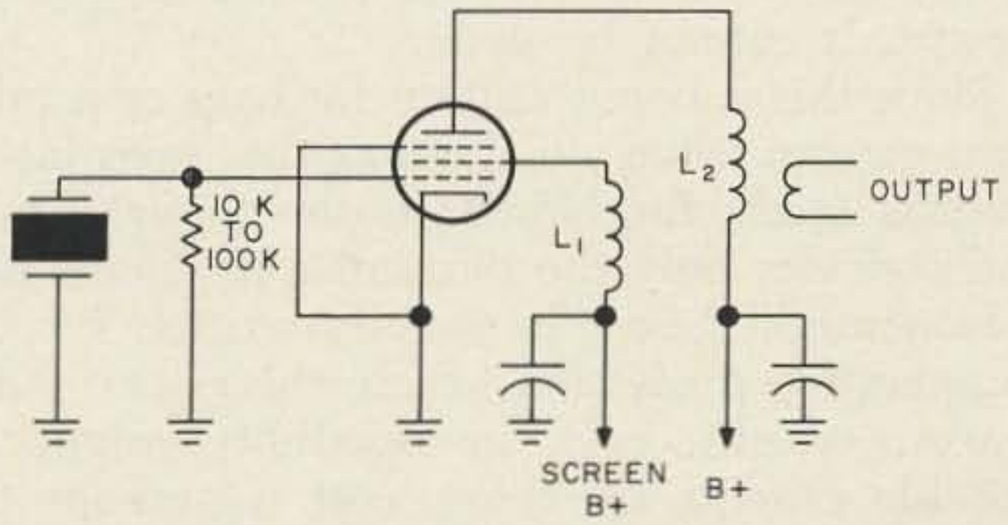
Again, a 6AG7 or 6CL6 can provide 48 mc or 50 mc output, from 24 or 25 mc overtone rocks and doubling in the plate. With this circuit a 2-tube 90-watt 6-meter CW rig could easily be built.

At lower frequencies, a 2-band CW rig could be designed around 7 mc rocks, a multiband tuner in the plate, and a pi-net output. Very little more would be needed to make it operate on 40, 20, and 15, and 10-meter use would not be impossible. Suitable tubes would be a 6CL6 and a 6DQ5, and input could run up to 120 watts or more. How about this for portable operation?

Some of the less-obvious advantages offered include easy crystal switching, since one side of the rock is grounded, and almost perfect isolation of the load at all frequencies so long as screen voltage is kept low enough so that the plate doesn't swing below the screen.

Let's be fair; this circuit didn't originate here. It came from Ed Steinberg, and was originally published in Electronic Design magazine. However, Electronic Design is an engineering-level publication with circulation restricted to professional engineers, and this circuit is just too good not to pass on. Have fun with it!

. . . K5JKX



L_1 resonates at xtal freq.
L_2 resonates at desired harmonic
SCR B+ should be regulated

More About SSB, DSB, AM, etc.

Thomas Prouty K6HJH
MHD Research, Inc.
Newport Beach, California

The battle started in the early 50's when hamdom divided against itself over "SSSC" (which was too much of a tongue twister to survive). John Costas made matters worse in 1956 when he added DSB as ground for further subdivision. I've followed this thing through the pages of I.R.E. (including the Professional Group on Communications Systems), Electronics, CQ, QST, 73, and heard it discussed in every other gathering of hams for about 10 years. It has grown out of all proportion and left men without the use of their reason—much like racial prejudice. I am finally compelled to have my say. Congratulations, W3AQT: you finally got to me (April issue, p 17).

The Ground Rules

There are generally two basic types of people who argue modulation systems. They are: those who understand and enjoy the mathematics of communications systems and those who understand a faint voice running 2 watts 3000 miles away but wouldn't know a Bessel function if they tripped over it. Most hams fall somewhere in between.

Since each group uses different approaches, they have divided the whole mess into two distinct battles, each with two sides. Most of the present confusion comes from trying to settle the matter once and for all in so general a way that it answers the problems of both groups. It cannot be done.

Since this is being written for ham consumption, we can leave out the jazz that goes into a systems study for NASA or the Signal Corps and consider only the particular problems that a ham might have. In articles written for the engineering profession, such things as input power, weight, cost, or reliability might be suitable criteria. Of these, cost is perhaps the only one which would also apply here, and more will be said later on this point although no numerical comparisons will be attempted. So from here on, this discussion will be concerned with *voice* (not sine wave) transmission, using a transmitter whose average power input to the final amplifier stage is limited to 1 kw. Just to keep things simple, it will be assumed that only the final amplifier contributes power to the antenna although more about this point later on. We will consider the fact that since a ham does not have control over both ends of the transmission circuit, he must determine the results of operation between his transmitter and the various types of receivers with which he may come in contact. (If you ever tried to operate wide band FM in the old days, you know what I mean.)

Finally, a word of warning—if you read the high brow magazines, make sure that arguments presented there are based on the same sort of comparisons that are important to you.

Power

One of the first things that must be considered is just what contributes to the ability of a communications system to transmit intelligence. At the receiver, the important thing is the signal-to-noise ratio, that is, the amount by which the signal exceeds the noise. Nowadays, nearly everyone is familiar with the concept of signal-to-noise ratio when used at the receiver but this involves a knowledge of the propagation losses, antenna gains (or losses), etc. If we used the concept of signal-to-noise ratio as it exists *at the transmitter*, we have in effect the same concept without the propagation and antenna considerations. Granted, the actual number of signal-to-noise ratio at this point might seem astronomically large, but if we further refine the concept by eliminating the temperature and Mr. Boltzmann's constant, we come to the concept of *intelligence power per cycle* of bandwidth. This is the real way to compare modulation techniques.

Many discussions on this subject bog down over a peak vs. average power argument. You

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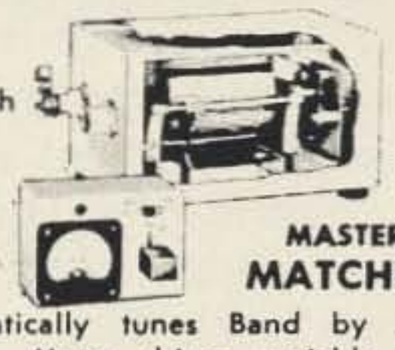

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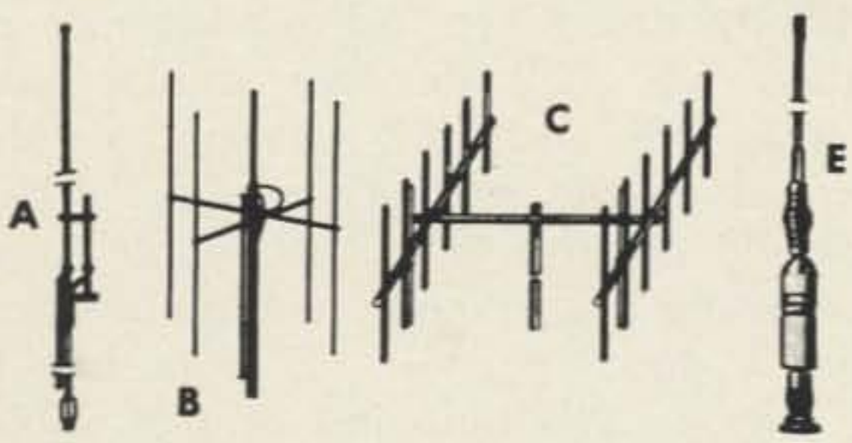

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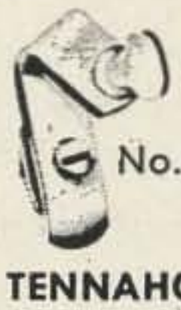

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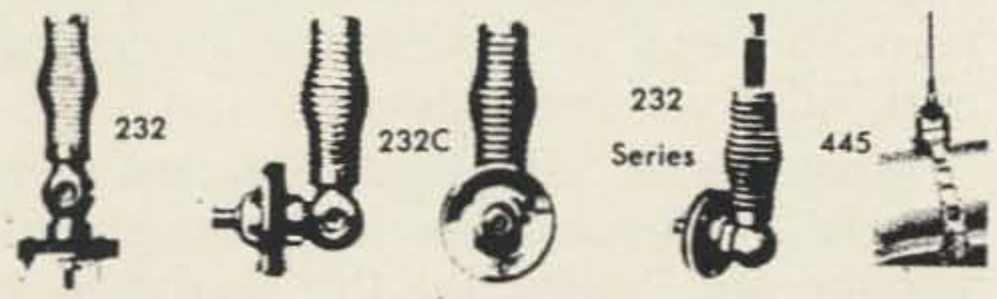

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have all heard the "2 kw peak envelope power" bit for SSB. Have you ever seen an AM envelope on a scope? Have you noticed that with 100% modulation the peak voltage is twice the unmodulated voltage? Since power is proportional to the square of the voltage, then it would seem that the peak envelope power for AM is 4 kw. Of this, 2 kw is in the peak carrier and 1 kw is in each peak sideband. So what! People don't talk in peaks but in a whole series of sounds having varying degrees of loudness. By clipping we can suppress the peaks and have a high average level. This is what must compete with the average noise power at the receiver.

Here's a New One for You

If you are still skeptical, let me simplify by giving an example. Consider a pulse code modulation system in which speech, having a spectrum lying between 300 and 3,000 cps, is sampled at a rate of 2 samples per cycle or more. The sampling rate must then be 6 kc/s or higher; let's stop at 6. Since we want to exceed the noise at the receiver with these pulses we will keep them at their maximum value at all times. Therefore, we will avoid pulse amplitude modulation (PAM) and use either pulse width modulation (PWM) or pulse position modulation (PPM). See Fig. 1 for a diagrammatic explanation of these modulation systems.

If we use PPM, all of the pulses are alike. If we use PWM the width will be varied above and below an average value. Since the modulation frequency does not go down to dc, we can assume the average value in our power calculations. Let's start the fun by assuming a 1 microsecond pulse width. With 1 microsecond pulses transmitted at a 6 kc/s rate, we have a duty cycle of only 0.6%. This means, that for an average power of 1 kw, we can use a peak power of 167 kw. . .!!!

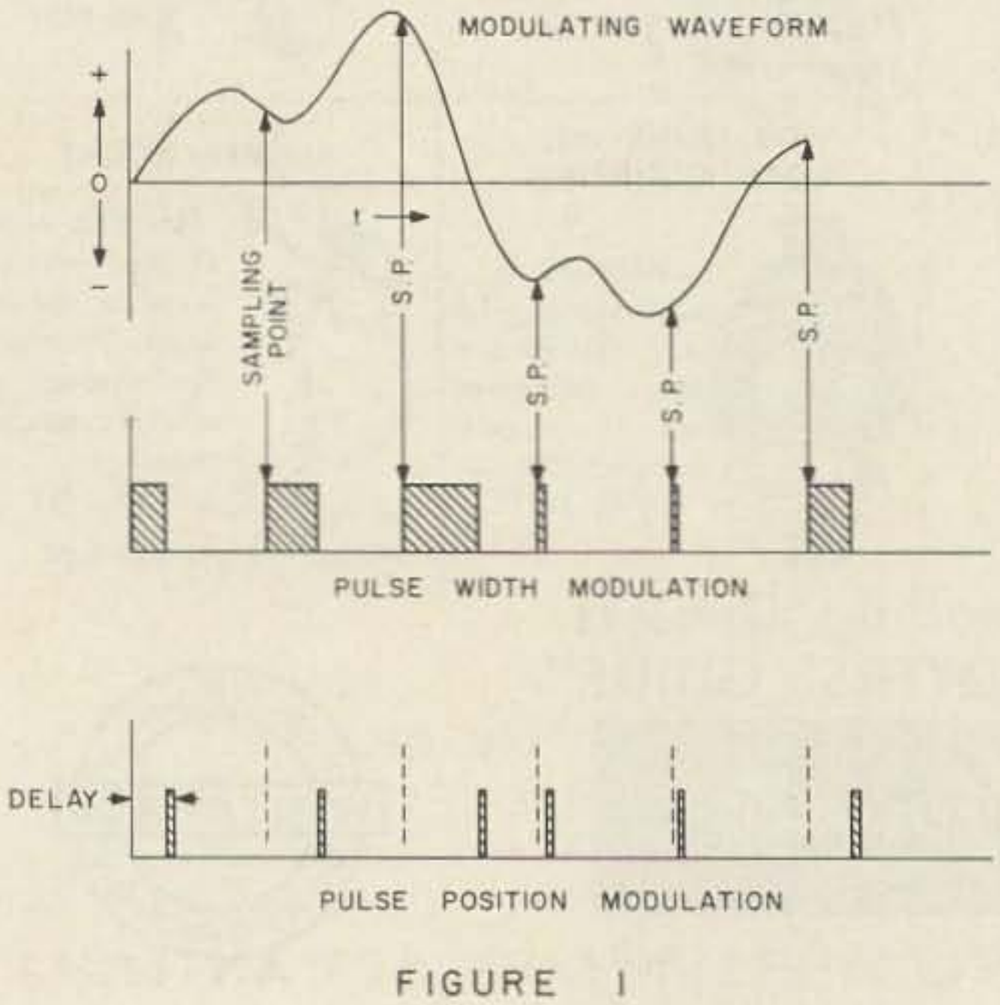

FIGURE 1

Before you go out and buy some big bottles, read on. The receiver must have a much higher bandwidth to handle this kind of a signal and therefore, its noise input will be higher. If we use a pulse which has a roughly triangular waveform, the receiver may have the minimum bandwidth. As the pulse gets wider, the receiver bandwidth may get narrower, so that as the peak pulse power goes down, so does the noise power at the receiver input. The sad truth is that for any practical combination of peak power, pulse width, and bandwidth, the power density which we may reach with this system is about 0.25 watts per cycle of bandwidth. Since this number may not mean much we shall develop similar numbers for AM, SSB, and DSB and see how they compare. But as you read, remember, if *peak power* would do the job, the whole world would be using pulse code communications. (Actually, a good portion of it is but for different reasons. A discussion of this subject is interesting but too involved to include here.)

Good Old AM

Let's look at AM for a minute. For 1 kw of carrier power we can put 500 watts in the modulation if we use sine wave modulation. But people don't talk in sine waves so the situation is somewhat different. Speech differs from a sine wave in the way in which its intensity fluctuates. Thus it is impossible to keep the level of modulation at or near the peak value without clipping.

What about clipping? Clipping helps in speech communications systems because all systems are limited by the hardware to the peak power which they may handle. By clipping, which we may also look upon as instantaneous AGC, we are merely smoothing out the peaks and valleys in our speech intensity profiles and enabling our transmitters to operate nearer their peak output for a greater percentage of the time. We are therefore, increasing the amount of the time when our signal will exceed the noise at some remote receiver. Clipping can be used to varying degrees with different types of communciations systems. With AM, very heavy clipping can be used. Even infinite clipping, or square wave modulation, is feasible and if you hide in one of the corners of some remote UHF band you can use such techniques; the splatter will keep you off the lower bands.

Just to give AM a real boost, let's assume

that we are using 100 percent clipping, or square speech waves. Now, instead of having 500 watts of audio packed onto our carrier, we have 1 kw. This divies up as follows: 1 kw in the carrier, and 500 watts in each of two sidebands. If we use both sidebands in the receiver, we have 1 kw of intelligence power (the carrier contributes no intelligence) spread over 6 kc/s or 0.167 watts per cycle. If the receiver has a 3 kc/s bandwidth and only uses one sideband, we have 500 watts spread over 3 kc/s or the same 0.167 watts per cycle. Without clipping, the power density is cut in half since we can no longer put as much power in the sidebands. Also, since the speech intensity will vary and we are limited to a peak intensity of 500 watts, the actual power density which we can achieve in practice is even less than half. Since "how much less" becomes a difficult question, let's just avoid it by assuming half. Then we can use 0.083 watts per cycle for AM with no clipping.

SSB

With SSB and an average input to the final of 1 kw then we will have just 1 kw of power to play with and if we are lucky, it will appear in just one sideband. (We will consider efficiency later). It doesn't matter whether clipping is used or not because it doesn't effect the average power one way or the other. With AM the power in the carrier is limited and we are trying to pack as much sideband power onto that carrier as we can. So we clip the speech to raise the average power that we can use without over-modulating. With SSB we have no carrier so we don't have the same problem. In fact, the only reason to consider clipping in the SSB case is that it might reduce the peak power demand on our linear amplifier.

Clipping must be used carefully with an SSB transmitter, however, since heavy clipping can actually increase the peak power demand on the final. Moderate clipping and filtering can be used successfully and if a high pass filter having a 6 db per octave roll off below about 800 cps is used ahead of the clipper with a low pass filter having a steep roll off above 2750 cps after the clipper, heavy clipping will give good results.

At any rate, clipping won't help us any here so we come back to 1 kw spread over 3 kc/s of bandwidth which gives a spectral power density of 0.33 watts per cycle.

DSB

In a recent article by W3PHL (73 Magazine, February 1963) quite a bit was said about the way in which the power should be delivered

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to a DSB final and the way in which it should be measured. Just to set the record straight, the conclusion which described a DSB final that packed in 1800 watts of average power is just not consistent with the legal limit of 1 kw. It doesn't matter what kind of complex logic you employ to get to a conclusion, a watt is still a watt and if RMS sensing meters having 0.25 second time constants are used to measure the volts and amps, then the result will be true power input (thermal equivalent) to the final on the same basis as it is in the case of an SSB final.

So with 1 kw of input to the final we will have 1 kw divided between the two sidebands. Again clipping does us no good since there is no carrier to consider and the effect on the size of the final amplifier is the only consideration that might make clipping worth while. The spectral power density is 1 kw over 6 kc/s or 0.167 watts per cycle.

What's the verdict? So far the spectral power densities look like this:

AM (no clipping)	0.083 watts per cycle
AM (100% clipping)	0.167 "
SSB	0.333 "
DSB	0.167 "
PWM or PPM	0.25 "
AM (no clipping)	0.0624 watts per cycle

Efficiency

W3PHL assumed 75% for a class C amplifier and 60% for a linear. These figures are probably representative of the best current practice so let's keep them. Then the table shown above should be modified as follows (assuming DSB to use a high level modulator):

AM (no clipping)	0.0624 watts per cycle
AM (100% clipping)	0.125 "
SSB	0.18 "
DSB	0.125 "
PWM or PPM	0.1875 "

Look who wins now! (I wonder what kind of a fight this will start.)

Receivers

For reasons to be explained later, let's examine the whole situation for several different types of receivers. The most important practical cases would include bandwidths of 3, 6, and 15 kc, plus synchronous receivers. Since a synchronous receiver is already pretty complex, let's assume that it has a number of "square" filters which the operator can select for optimum reception of any given signal. Also, I like to give phase coherent receivers an advantage in signal-to-noise performance of 1.414 instead of 2 as is often quoted for them.

Watts per cycle of receiver bandwidth

System	Receiver			
	3 kc/s	6 kc/s	15 kc/s	Sync
AM (no clipping)	0.0624	0.0624	0.025	0.0882
AM (100% clipping)	0.125	0.125	0.06	0.176
SSB	0.18	0.09	0.036	0.18
DSB	0.125	0.125	0.06	0.176
PWM or PPM	0.093	0.187	0.075	0.264

Note: The pulse width used with PWM or PPM has been assumed to have been optimized for 6 kc/s receiver bandwidth to show the effects of non-optimum receivers on system performance. The pulse width could easily be changed to suit other receivers.

Conclusions

No one should be caught dead without speech clipping on his AM transmitter. If you can afford one, you should have a synchronous receiver. From there on, it is up to you. There really isn't much difference. Just remember that some judicious filtering will be required if you want to use PWM, PPM, or heavy clipping without splatter.

Discussion

OK, you say, so all this jazz is fine but what makes the SSB signals get out when the AM Signals don't? I think the answer to this is not to be found in the science of radio but in the practice of it. First, SSB is more complicated and therefore has been practiced more by the better educated and equipped ham, or by the ham who chooses to buy his rig. So the transmitter is probably a little better. Second, SSB addicts found long ago that that stability requirements forced them to pretty good receivers and this produced a sizable improvement all on its own. Thirdly, there is the subjective factor of not having all those heterdynes. Fourth, the convenience of VOX operation make the whole thing more enjoyable. These factors plus the "real" improvement due to SSB account for what happens—I think.

Now for the practical approach. Most of the preceding junk assumes that you have plenty of money, the whole band to yourself, and control over both ends of the circuit. But it is just not so in true life. Most hams have some purpose in their hobby. If operating is the one that interests them, they must operate with some other ham or hams. So each one has got to pick his intended receivers. If you like to talk to the SSB crowd, don't go on AM—you won't make it. If DX is your real aim in life, why not brush up on your code? (I'll bet you thought we would overlook CW altogether—didn't you?) If new things interest you, try DSB and consider building a synchronous receiver—I am.

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That probably didn't satisfy many of you. Let's consider a different tack. You don't have a key to Ft. Knox so the cost per watt is important.

The grounded grid linear amplifier deserves special mention here. Its simplicity, low cost, and the fact that it can be "over 100% efficient" (remember that drive power also contributes to the output) make a strong case for transmitters based on this. Also the high price of high level plate modulators should be considered. These facts, coupled with the 50% duty cycle of average speech and the effect this can have on power supply requirements makes a very compelling case for SSB and DSB. Stated another way, the average ham has a better chance of getting the legal limit if he uses the lower cost SSB and DSB systems than if he uses AM. If he doesn't want a big voice but can be happy with 10 watts, then the picture changes and AM looks good. Don't ask me where the cross-over occurs!

Consider who you leave out though when you plan your system. Nearly everyone is now familiar with SSB tuning and nearly any reasonable receiver will do. Those with receivers that have at least one steep side to their passband can copy DSB, some won't even know that the other sideband is there. But those with wide conventional receivers can't copy DSB at all.

To summarize it all up, let's make some simple statements:

1) If you use AM, use plenty of clipping and filtering.

2) If you can afford it, buy or build a synchronous receiver.

3) Choose a system to suit your tastes, the mode your friends use, or the amount of money you have. There is scarcely 6 db between the worst and the best and a little time spent on your antenna will nearly always be more rewarding at less cost.

4) If "maximum effectiveness" really bugs you remember that the only reason we didn't include a big discussion of CW here is because it would shame everyone out of the place —you can pack in 5 watts per cycle without even starting to get fancy and at less cost than any other system.

5) Please forget all about PWM and PPM. They are hard to put to practice and the splatter problem is fierce. And think of the arguments this would start.

6) One of the things that keeps our hobby so active is the fact with all the scientific methods at our disposal, there are still no "right" answers to all problems and everyone can develop, practice, and talk about his own opinions and ideas.

. . . K6HJH

An Inboard Calibrator for the NCX-3

George Morton WB2MAH ex W4HUP

Photos by A. J. Spatafore WB2FGL

Many hours spent reading the myriad brochures on tranceivers resulted in the purchase of a beautiful new NCX-3. After careful unpacking and a brief inspection of the instruction book, I hooked everything up and put out a CQ on the low end of 75. "Get back in the phone band," said a voice. "But I am in the phone band," said I. "You are two kc out," replied the voice. Sulking, I tuned up on CW down in the Novice band and got a calibration check from a friendly novice who was all too pleased to tell me his crystal freq. For the time being at least, I was calibrated. As much as I hated to face it I needed a calibrator. My checkbook was still recovering from the shock of almost $600.00 spent on the NCX-3, power supplies and other accessories; so it was no surprise that another $27.00 wasn't readily on tap. Besides, I didn't like the idea of anything sticking out of the rig when I put it in the mobile. I would have to make a calibrator and then I could mount it inside the NCX-3.

National engineers used the shoehorn treatment to squeeze all those components into that little box, so there seemed to be no room for a calibrator—or any thing else. Consultation with my good friend, Jack Daniels, produced the opinion that normal mounting was out of the question. I guess this is the conclusion that National's boys came to or else they wouldn't have made provision for mounting one outboard.

Looking the problem over in a new light I found there was enough room for a small

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chassis behind the meter. If the tube and crystal were installed horizontally instead of vertically there was more than sufficient space there. Digging through the junk box I managed to come up with all the parts except the crystal, I even had a piece of aluminum that could be cut to make a chassis. A call to one of the locals resulted in a swap of a pair of 6L6s for a crystal.

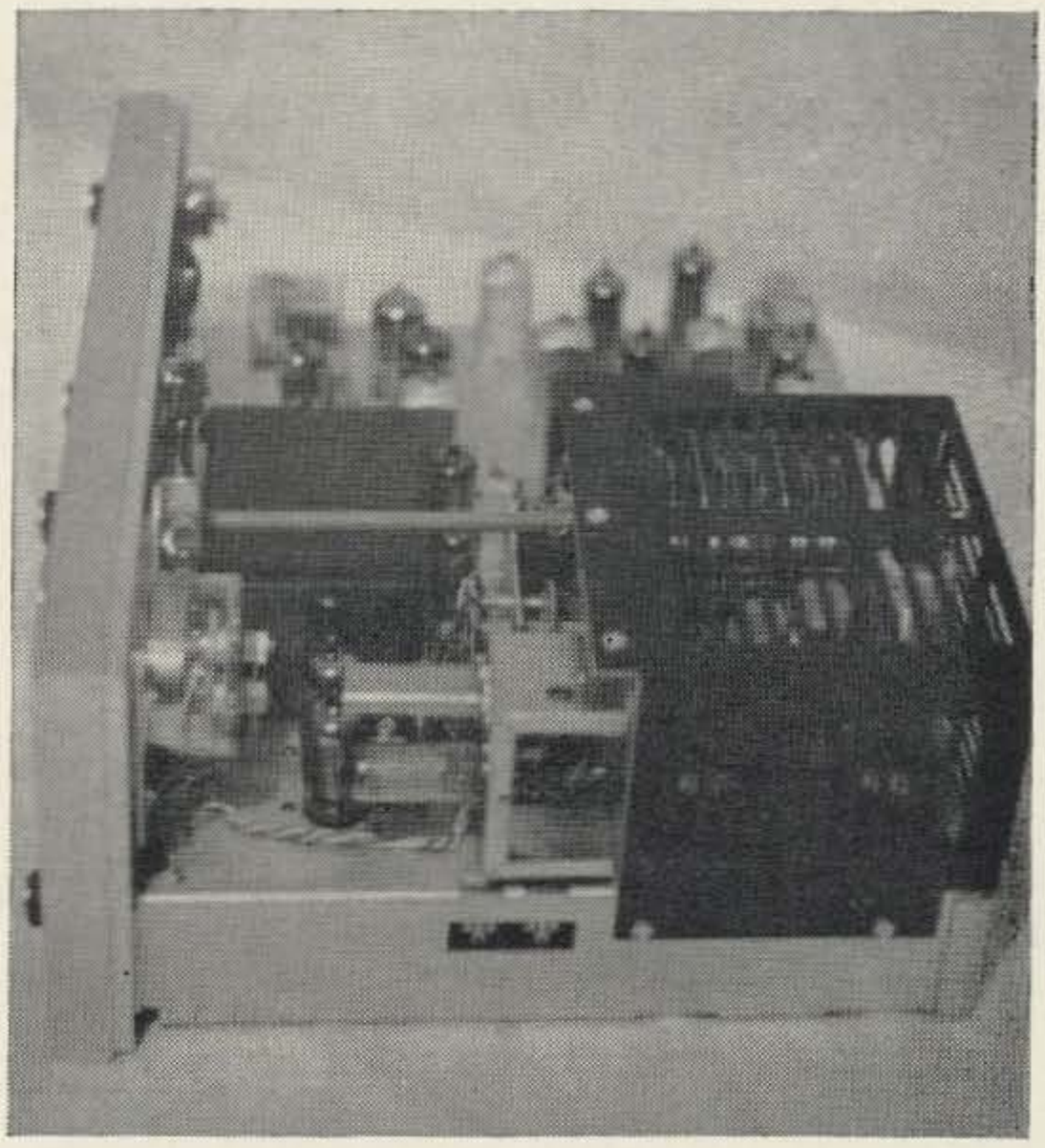
Chassis Construction

Cut a piece of aluminum to 6" x 2". Cut small notches 1¾ from each end on both sides, make these notches ¼" deep as shown in Fig. 2. Cut in ¼" from all corners, drill holes referring to Fig. 2. Holes for mounting the crystal socket are under *1*, the grommet hole under 2, space for mounting C 1 under 3, *4* is the tube socket cutout and 5 is the hole used to mount the terminal strip.

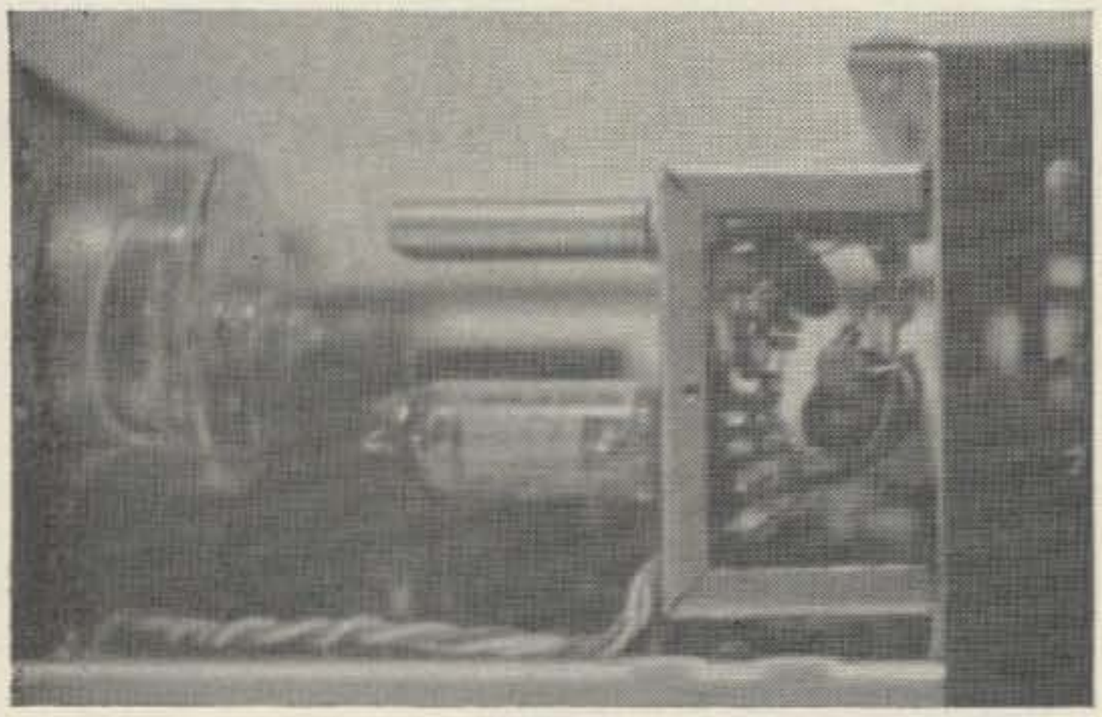
Bend the aluminum on the dotted lines as shown on the template, to form a chassis. Look at Photo #2 and you will see that there is a quarter inch lip all around, the lip on each end of the chasis as shown should be bent the opposite way so you will have surface to mount the calibrator in the NCX-3.

Wiring

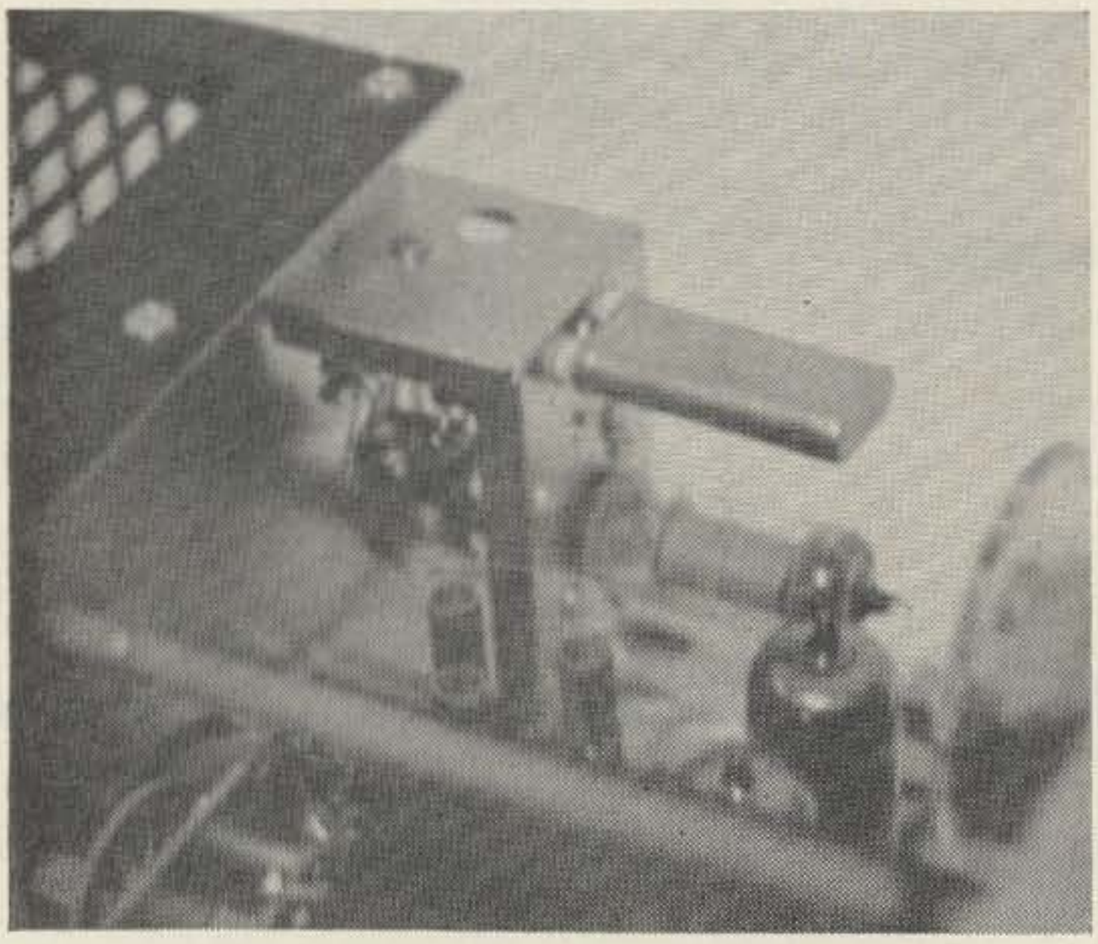
Mount the tube socket, crystal socket, terminal strip (3 term & ground), and the grommet. The type of trimmer you use for C1 will determine what size hole(s) you will need there. Mount C1. Run a small piece of bare wire



Just like in the sales brochures except something has been added behind the meter. Wiring from the calibrator can be seen running to the large hole under the meter for internal connections.



Mounting detail showing chassis placement. Change in position of crystal and tube in new installations (see text) is suggested.



The calibrator fits in perfectly, be careful not to hit those coils just to the left of the calibrator.

from one of the terminals on C1 through one of the pins of xtal socket and to the ground lug on the terminal strip. Ground pins 2. 4 and 7 of the tube socket to the ground lug terminal. Mount C4 (10 mmfd) from pin 5 of the tube socket to one of the terminals on the strip. R3 goes between two of the terminals on the strip. Finish wiring as per diagram Fig. 1. Solder a piece of #18 hookup wire 24" long to pin 3 of the tube socket. Three more 24" lengths are soldered to the terminals of the terminal strip; the ground lug, the B+ end of R3 and the output side of C4. These go through the grommet. Parts values and layout is not critical as long as reasonable tolerances are considered. L1 should be mounted in such a manner that it is equidistant from all ground points for maximum output.

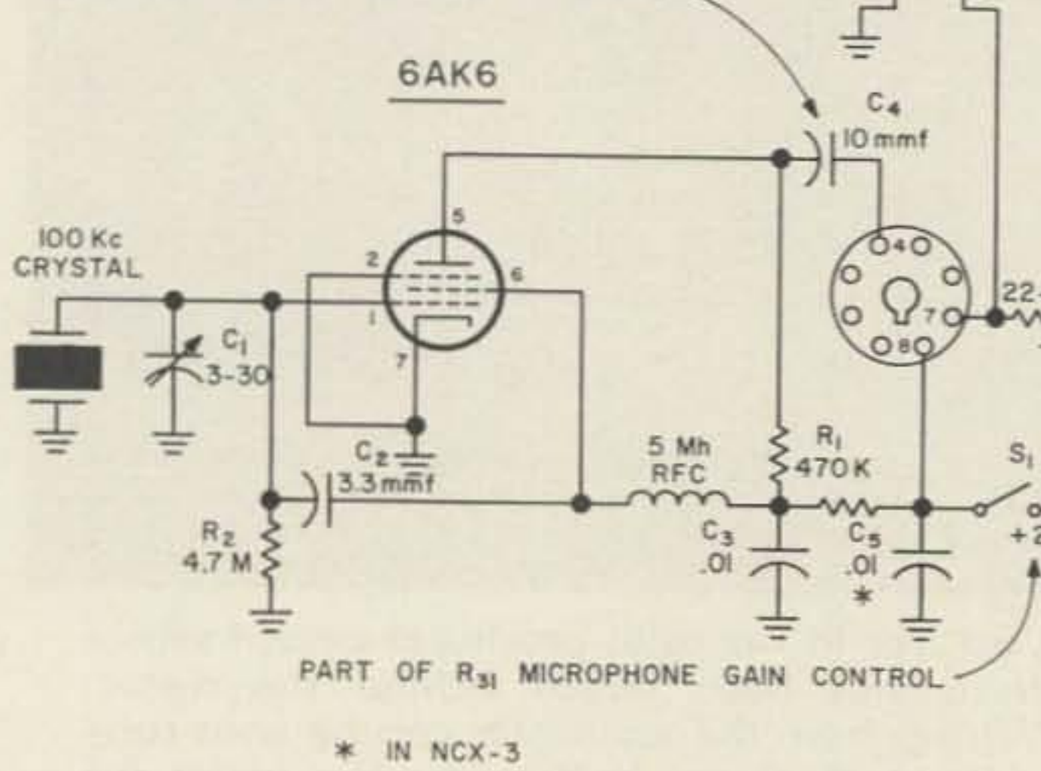


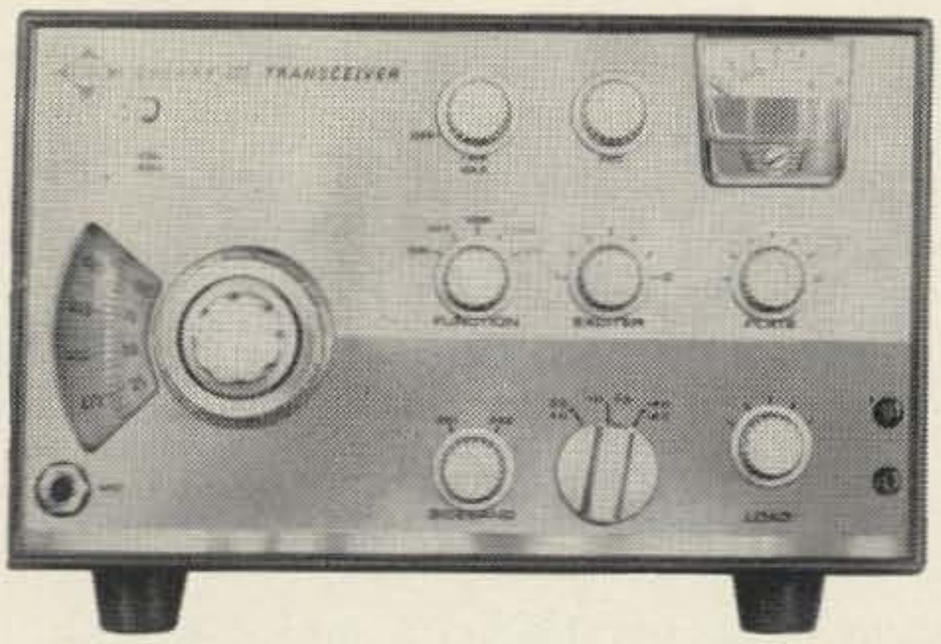
FIGURE 1

Installation

Not wanting to drill holes or otherwise foul up my new pride and joy, it was decided that a new means of mounting the sub-chassis would be needed. Glue was the answer. Yes, glue! Not model glue, but that expensive Dupont stuff guaranteed to hold two boards together so well that wild horses couldn't pull them apart. Thirty five cents will buy about 100 times what you will need to do the job, so maybe you can borrow some from a neighbor.

Under chassis wiring of the calibrator follows the wire harness (white arrows), the ground lead is connected to ground terminal next to hole in upper LH corner.

Apply a thin coat of glue to the areas to be joined and then press firmly into place as shown in the photos, with this exception; the tube should be on top and the crystal the bottom. This will protect the crystal from excess heat in your installation. I have had no adverse effects but if I had it to do over again I would do it the other way. Besides if you mounted it like I did you will have the grommet and wires feeding through it away from the chassis if you followed Fig. 2. The template was drawn with this revision in mind. Don't worry about the ability of the glue to do the job. I have had this rig in and out of the mobile and fixed set-up for three months now and it is as sturdy as ever. I haven't had a chance to get any wild horses yet, so I will make no promises on that account. The only problem with the glue is in getting an effective



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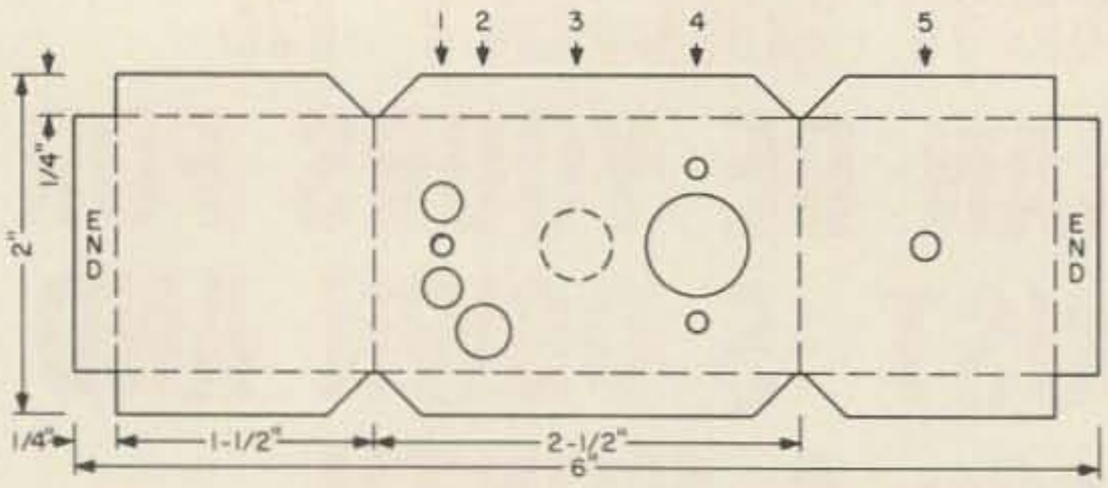

FIGURE 2

dc ground. This is why we ran a wire from the ground lug of the terminal strip.

After giving the glue time to set, run the wires from the grommet through the hole under meter. The photos will give you an idea of how it is done. Connect the ground lead to the ground lug on the first terminal strip you come to under there. Run the others toward the back of the chassis following the wire harness to the calibrator socket at the rear of the NCX-3. The little white arrows in the photo shows the way. The calibrator output lead goes to pin #4 of the socket, the filament connection to pin #7 and the B+ lead to pin 8.

Plug in the tube and crystal, turn on the power and you are ready to try it out. Allow a few minutes for things to cook a little, then pull the mic gain control out, this will apply B+ to the calibrator (a switch is part of this control for exactly this purpose). You should find a strong signal near one of the 100 kc dial divisions. Eureka, it works!

To zero the calibrator it is necessary to use a receiver capable of tuning WWV or a local BC station that operates on a multiple of 100 kc. Run a short length of wire from pin #4 of the calibrator socket in the NCX-3 to the antenna input of the other receiver. Zero beat and you are set. Be careful if you use ac/dc set and a BC station as your standard, you could get quite a charge out of the calibration. After zero beating your reference sig, button it up and you are in business, safe from fear of an FCC QSL.

. . . WB2MAH

Parts needed in addition to those shown in Fig. 1:
2 x 6 inch piece of aluminum for chassis
seven pin miniature tube socket
three terminal and ground terminal strip
crystal socket
Miscellaneous mounting hardware

Push-to-Talk for the HT-37

Rolf Carlson W2ZBS

When the background noises in the shack get unusually loud (two small harmonics running around), the author on occasion has wished for a push to talk circuit in his HT-37 for more positive control over the station's operation! Anyone who has used voice control (VOX) knows its susceptibility to sounds other than the operator's voice. In looking over the circuit diagram, it was obvious that a push to talk modification for this transmitter could be accomplished in several ways. However, the author desired a) the simplest and easiest modification, and b) no changes to the normal operation or appearance of the transmitter.

The modification to be described here requires installing a phone jack and a piece of hookup wire soldered between the phone jack and a terminal strip in the VOX circuitry. That's about as simple a change that can be made these days! (Fig. 1.)

Now that you see there is hardly anything to it, let's install the change.

First, before we do anything, look at the back of the HT-37. If your unit is similar to the author's (serial # 259222), you will notice two ½ inch diameter unused holes, one near the 11 pin control outlet and one near the 50 ohm rf coaxial plug. The phone jack used in our modification is installed in the ½ inch diameter hole nearest the 11 pin control outlet. The next thing to do is to remove the top cabinet cover by removing the four screws on the sides.

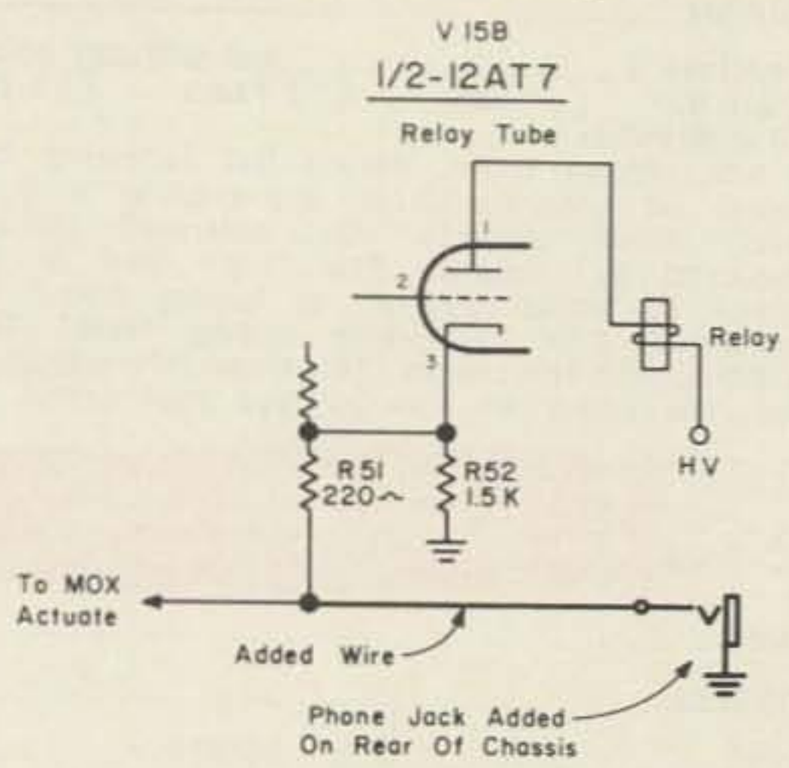

FIGURE 1

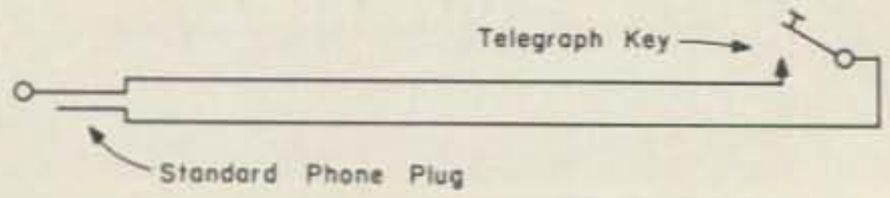

FIGURE 2A

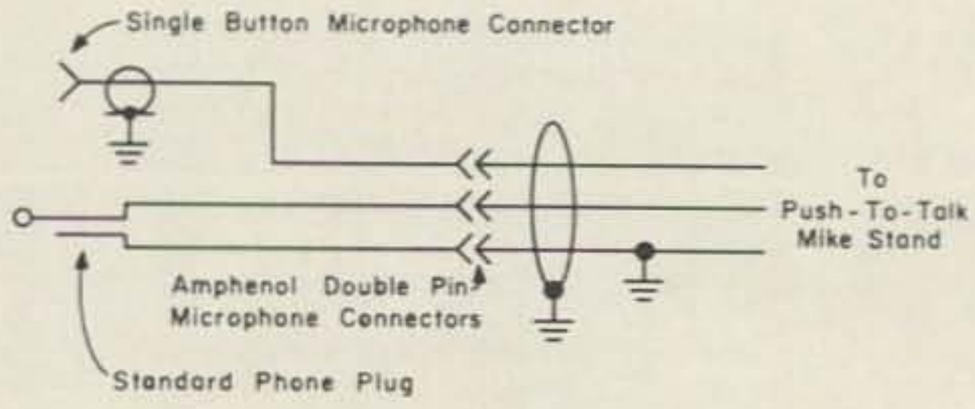

FIGURE 2B

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Then turn the transmitter upside down (after removing the 5R4GY rectifier tube so it doesn't get squashed) and proceed to remove the screws that fasten the bottom cabinet half. Now install the phone jack (make sure it is not the shorting type when the plug is out) and route a piece of hookup wire from R51 (220 ohm resistor) to the phone plug. Solder the wire to the resistor on the end opposite to where it is attached to the cathode pin 3 of VI5B (½ 12AT7). Solder the other end of the wire to the hot connection of the phone plug. Replace the cabinet halves, the rectifier tube and that's it.

Fig 2 shows two possible methods of use. (A) shows the simple expedient of using your telegraph key as a control device. With this method, the VOX sensitivity control is turned fully clockwise to prevent any audio from picking the relay through the VOX circuitry. All operation positions work normally except that in the VOX position the transmitter is put on the air with the closing of the telegraph key.

Fig 2 (B) shows how a cable with suitable microphone connectors is uesd with a push to talk mike stand. In this case, since the hot lead of the microphone cartridge is grounded when the push to talk switch is open (true on an Actatic model G stand), the VOX sensitivity does not have to be turned down. To use this method, just insert the phone plug in the rear, and the mike connector in its normal position on the front panel, and you are in business. If you should desire normal VOX operation again (after the kids have left the shack) just pull out the phone plug, lock the push to talk handle in the closed position and everything works as if nothing had been done.

That's it . . . a simple enough change to add another degree of versatility to an already fine piece of gear.

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- Direct reading dial scale calibrated in 2 kc increments. Dual tuning knobs provide choice of fast 6:1 ratio or slow 36:1 vernier tuning.
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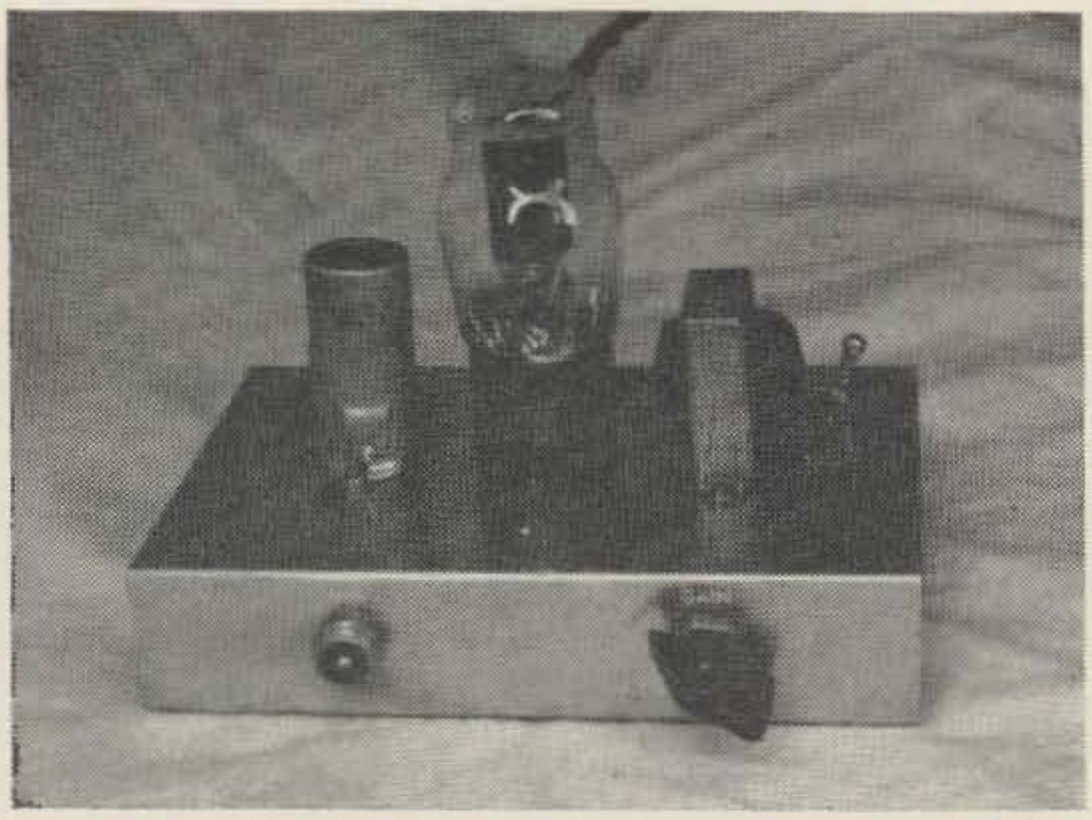

The Gardner Modulator Revisited

Barry Hoyt WA2AKK
25 Edgewood Rd.
Peekskill, N. Y.

Soon after I passed my General Class exam, I searched for a simple and effective means of modulating my 50 watt CW rig. As I had not yet accumulated enough junk to make a plate modulator economical, some other form of modulation would have to do. I ran across the Gardner circuit in Volume five of "Hints and Kinks" and built the whole thing for less than five dollars, exclusive of tubes. It was my orginal intent to use this as an interim modulator until I could get something better going. The little thing worked like a dream and a slight modification of the original design made it even more effective. However, the time came when the lure grew too strong, and I built a plate modulator. The thing was large, heavy and noisy (the surplus modulation transformer *was* running a shade over its ratings) and, to my great surprise, showed no *noticable* improvement in modulation strength and quality when compared to the Gardner circuit in the same QSO. These tests were made over both long hauls with marginal signals and local work. When the shack was moved to the basement, I went back to the little cathode modulator and have been using it exclusively for over three years with consistent reports of excellent audio quality and good "punch." Its operating qualities and simplicity makes one wonder why it has been almost completely ignored for so many years.

Circuit

The basic circuit is shown in Fig 1. It consists simply of a class A amplifier connected between the cathode of the modulated stage and ground. Modulation is applied simultaneously to the grid plate and the screen if the modulated amplifier happens to be a tetrode or pentode. This eliminates the need for a coupling transformer with its associated impedance matching problems and also makes it possible to eliminate the need for a separate plate power supply. In addition, high voltage for the speech amplifier is available through an audio choke and capacitor filter from the modulator plate. Thus, if supplied with filament voltage, the modulator can be "installed" simply by plugging it into the cathode key jack of the final amplifier. This makes it an attractive circuit for use with portable rigs and most inexpensive CW-only rigs.

Fig. 2 shows the complete circuit with a speech amplifier using a more modern tube than the original. In addition, a 500 ohm potentiometer has been added in the cathode of the 6Y6 for adjustment of operating conditions. The speech amplifier shown is for use with a high impedance mike. A carbon mike circuit is shown in Fig. 3 which has been used success-

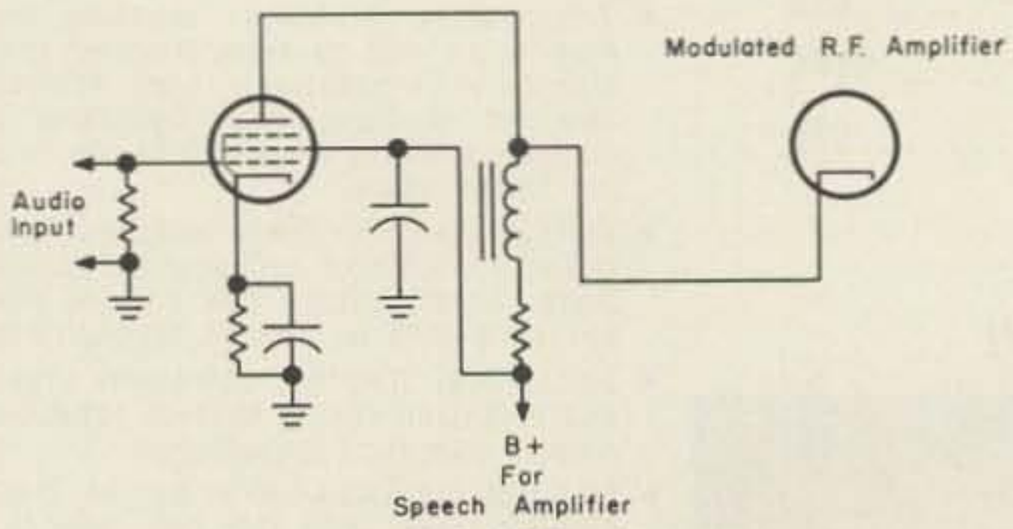

FIGURE 1

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Construction

It is only necessary when building this unit to keep all leads short which are going to the first speech amplifier stage and to shield the lead from the mike connector to the grid of the 12AX7. If rf feedback occurs, it may be necessary to filter the input circuit with a .001 pf capacitor to ground and an rf choke in the grid lead.

If the modulator is to be permanently stalled in the transmitter, it might be better to take supply voltages for the 6Y6 screen and the speech amplifier plates from an existing high voltage source in the transmitter through a dropping resistor. A switch, S-1 is provided to change the transmitter over from phone to CW. The circuit as shown is capable of modulating an amplifier whose plate current in this

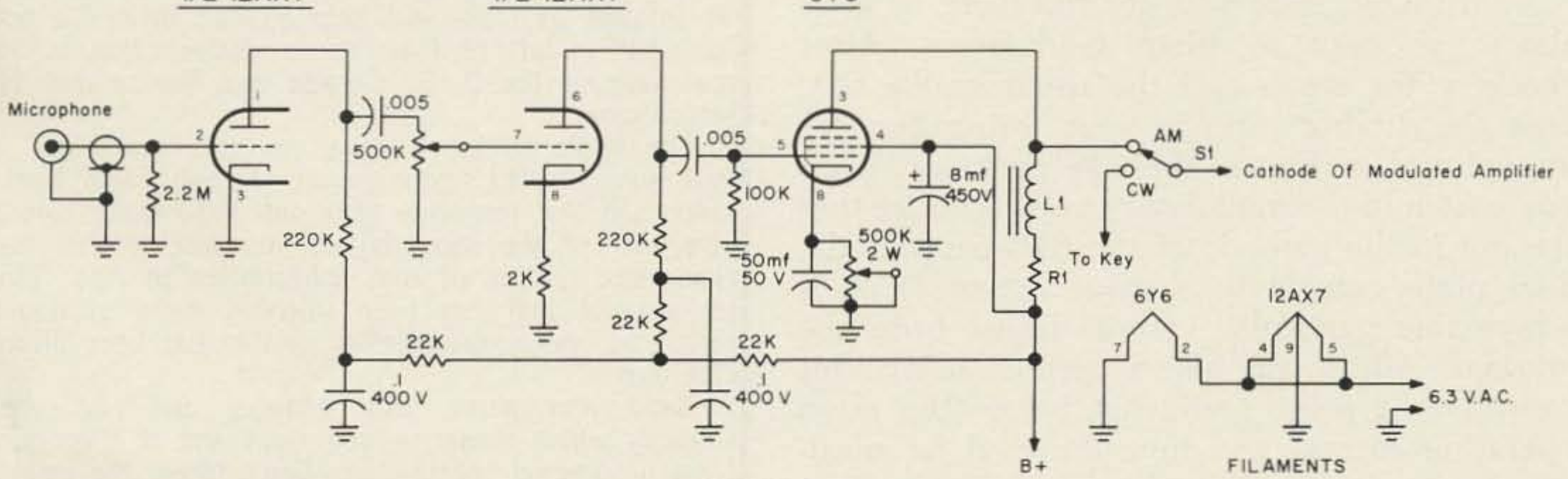

FIGURE 2

L1—any small audio choke, 2h or more or the plate side of a small output Transformer

R1—nominally 2000 ohms, 2W, adjust to higher valve if 6Y6 screen voltage exceeds 135V

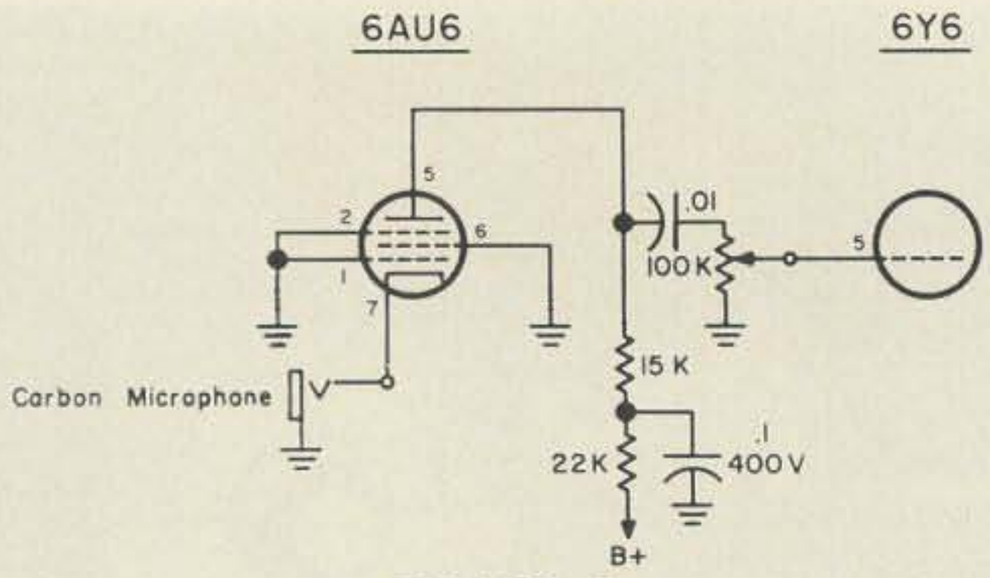

FIGURE 3

mode of operation does not exceed about 100 to 120 ma. To find this current for your transmitter, look up the recommended plate modulated conditions for your final tube at the voltage available and use about 80% of this value. If this is over 120 ma as mentioned above, use two 6Y6 tubes with all elements tied in parallel.

Make sure, at any rate, that the maximum screen voltage of the 6Y6 (135 volts) is not exceeded and that the plate voltage of the 12AX7 does not exceed 300 volts. Be sure to check these voltages on standby as well as when the transmitter is under full load as on occasion these might be exceeded by quite a bit and you will be wondering where all the 6Y6's are going.

One more word of caution: be sure, especially when working with fairly high voltages on the final, to apply filament voltage to the 6Y6 before any high voltage is applied to the final. This will be taken care of in most rigs if the filaments of the modulator are tied in with the other filaments or are at least arranged so that they come on when the others are turned on. In arranging phone–CW switching, do not remove filament voltages from the modulator when operating CW lest you inadvertently switch back to phone and immediately apply high voltage.

Adjustment and Operation

Adjustment, once you get the hang of it, is almost as easy as plate modulation. After checking for errors and the usual smoke test, tune the driving stays in your transmitter for normal grid current in the CW position. When you switch in the modulator you will notice that the pot in the cathode of the 6Y6 controls the final plate current to a great extent. This is where this particular circuit differs from the original. Adjust the plate current using this control to a point somewhat below the rated operating current and tune the final for maximum output as indicated on an rf voltmeter, ammeter, FSM or scope. Bring the plate current up to the value determined earlier in the article and advance the gain control while speaking into the mike until there is a flicker in the plate current on voice peaks. If you have a scope available it would be wise to adjust the modulator until some clipping action is seen. If the plate meter is observed to flicker downward or clipping appears on the scope before any appreciable upward modulation takes place, increase the loading to the final or decrease the plate current with the cathode pot, or both, until more upward modulation is indicated on the scope or the plate current is observed to flicker slightly upward.

It will be difficult to note a dip in plate current as the final tank is tuned through resonance with the modulator in the circuit and you must use some means of indicating rf intensity to tune up. This can be anything from a 9c neon bulb to a Bird wattmeter as long as you can tune for maximum output. Don't worry about blowing your final during this process as the modulator will prevent excessive plate current.

At this point you should conduct a test with a station who is receiving you about S-9 on a QRM-free band to determine that your signal is free of hum, noise, distortion and splatter. Once this test is passed, you are ready to enjoy many trouble free QSO's–and if you don't tell any one that you're not plate modulated, they will never know.

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Now Hear This Fellow Amateur

Frank Phillips W4LCY
Bangkok, Thailand

Recently, there have been several notable amateur personalities who have expressed their views concerning the fate of amateur radio. Generally speaking, all of the views have made one thing clear, and that is, the amateur will have to increase his value toward public service in order to maintain his existence. Many qualities and quantities were noted and pointed out which over the years we amateurs have taken for granted and as a result, has caused us to lapse into a false sense of security.

In looking over the ham bands in their present state, it is quite obvious from the way the frequencies are being utilized that a general up-dating is in order. Progress can be made in technical achievement, operating proficiency and proper use of equpiment. I agree with one author in that the frequencies are being used to a great extent in "projecting personalities" rather than in something more constructive. It is all too true that many amateurs are more adept at buying their equipment instead of building it, with the consequent loss of technical ability. No doubt this is the aftermath of "our times" and the fact that "getting on the air" has been made too easy. However, the purpose of this article is not to review what has been said previously, but to point out that the amateur is not the only one lacking in incentive and regardless of how perfect, or valuable we may become, it will have little bearing on the outcome of future international conferences. If this bit of information shocks you, then the forthcoming information is intended to enlighten you.

Previous discussions on this matter have been glaringly superficial as they have tended to place the amateur in a poor light while supporting the other inhabitants of the frequency spectrum as being faultless, infallible and above reproach. Nothing could be further from the truth. We are all familiar with the fact that there are two sides to everything. Let's take a look at the other side. The side that various spokesmen are reluctant to bring out; depicting the typical human trait of deliberately avoiding the responsible issues, or not being adequately informed on the subject to a point where they can speak factually.

For some time now, the amateur service has been a sore point with a number of countries who would much prefer to see the ham bands used for other purposes. This is not to say that they would use the frequencies for the general welfare of the international public, but it is to say that they would like to see them used for *their* purposes. It is a well known fact that there are countries who are completely hostile to an amateur service. It would not be difficult to comprehend this source of hostility if you were to closely scrutinize the basis for this state of mind. You will find communications systems that are inefficient due to poor engineering, there is a shortage of trained personnel to operate these systems, there is opposition to acceptance of new and better modes of communication, there is no insight to any problem related to communications, they do not abide by the edicts of the ITU, (except on paper), and communication posts in their governments are filled by political appointment rather than on the basis of technical competence. They have never contributed to the art, and furthermore, they never will. They are quick to tell you that there is no need for them to delve into research, or experimentation, when they can purchase what they need on the open market. From the foregoing, one can deduce that this is not a healthy environment for the support of an amateur service. They just don't want any. They point out that the added load of an agency to handle amateur

affairs and monitoring of the ham bands constitutes too much of a bother to warrant an amateur service. What they don't tell you is that they would much rather allot the frequencies to business enterprises because of the added revenue in taxes that would be available. How can you possibly sell them the idea of having amateur radio when their outlook is mercenary. It is impossible. So what happens at an ITU conference? They vote against an amateur service! The only way that they would possibly vote in favor of amateur radio is that if there were something in it for them. Something tangible, that is.

It is a little known fact that in trying to cope with the frequency problem, one of the retarding aspects to a satisfactory solution is that many representatives do not "see" the problem as those who are more versed in communication engineering from a standpoint of long association or experience. In other words, the human factor is more of a governing agent than an enginering one. Just because a person is from the other side of the world, he doesn't comprehend the problem the same way that you do. How the laws of physics, or the requirements of an engineering necessity can be altered by human whims has always been the primary negotiating obstacle at an international conference. Nevertheless, it's there.

Also another ironic reality is the fact that many countries whom we have to cajole at the conferences, are, or have been in the past, recipients of technical aid in one form or another. Although original impetus was lacking in the initial stages of radio communication, they are now "experts" in the field and they are now in the position to vote prohibitively concerning amateur radio affairs. I would also venture to say that if some of the representatives at the ITU conferences are indicative of many of the communication officials in governments whom I have encountered, they haven't the faintest notion of the history, achievements, or functioning of an amateur service. This means one thing which is a natural defense when ignorance prevails. If you don't understand it, or don't know what it is; vote against it!

In looking over some of the reasons why the non-amateurs have their cold, envious eye on the ham bands, you will find that most of them are about as ridiculous as they can be. As a beginning, there is this notion of public service. A close look at the frequencies being used for shortwave broadcasting will reveal that in the true sense of the word, they are not being used wholly for a public service. Would an intelligent person admit, for exam-

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ple, that Radio Moscow with their type of broadcasting constitute a public service? Let's not be naive. Take any one country as a hypothetical case. Can it be said that the broadcasting of their "virtues" to the rest of the world be in complete accord with a public service. Public service to whom?

It has been pointed out that nearly thirty new countries have come into being as brand-new nations in the past few years, with a strong feeling of pride in their newly found sovereignty and a desire to broadcast their virtues and philosophies to the rest of the world. Is a desire for broadcasting of mere virtuous and philosophical beliefs a truly valid justification for adding more congestion to the present enunciations on the frequency spectrum? Very few possess technical background sufficient to intelligently sanction modes of communication to fill their needs. Regardless of their capabilities and shortcomings, however, they are allowed to vote at a conference.

This brings up another point. It was further proclaimed that in order to foster democracy, this is the way it has to be done. With no reference to technical background, every nation has a vote. This one aspect alone is the reason the frequency spectrum is in a sordid mess. The allocation of frequencies is no longer a result of necessity, or engineering endeavor, but rather one of politics. Vulnerability to political stratagems is the prime reason for the state of the frequency spectrum today. This must be true, obviously, as the present state of frequency misuse will substantiate this. The complexity of frequency shortage and frequency misuse presently on a world wide scale is due more to a human factor than a technical one.

Another so-called factor that was brought to our attention was the need for a country's "vital" communications. Monitoring the high frequency bands will further reveal from that which is propagated it is extremely difficult, if not impossible, to differentiate between the "vital" and the inconsequential. Shortwave broadcasting for informative purposes is no longer a necessity as it once was. Even in remote countries people are watching TV programs and not listening to shortwave broadcasting. An objective look at this service will determine conclusively that the multitude of stations are not an absolute necessity. If radio communications is not a toy, or a hobby, then why is it being used indiscriminately in the broadcasting field?

Some learned minds have said that the so-called leading nations have to go along with what is available in the way of administration, otherwise chaos will reign. What is the higher two-thirds of the forty meter band in the Western Hemisphere if not chaos? In some areas of the world the eighty meter band as well as the forty meter band is chaotic! Ask those who have lived in Asia about the state of the frequency spectrum there. From the low end of the broadcast band to 30 megacycles it is a shambles. For the "authorities" who have never gotten any farther from the continental limits of the United States than to Geneva, the use of the frequency spectrum as it shouldn't be used has already been ushered into that part of the world. Whether a BC receiver is available or not, it makes no difference. A shortwave receiver will fill the bill nicely as the second harmonic of any BC station can be received with no drop in quality. Harmonic filters are just two words in a textbook. If you don't know better, you would believe that the raucous CW signal was a status symbol in Asia. The accepting thing is the signal with 130% modulation. It is virtually impossible to use the time standard stations WWVH and JJY on 10 megacycles because of the commercial RTTY stations riding on top of them. If you desire to use any particular frequency the usual method to to tune up, the more power the better of course, and then sit on the key for a few days. After you have driven everybody off, you have a clear channel. Every local shortwave broadcasting station has a VFO. As the QRM builds up they shift their frequency in an effort to find a clear spot. That is, if they can find one. Frequency allocations? That's kid stuff.

There is one country in Southeastern Asia with which I am thoroughly familiar. The size of this country is about that of Texas. Do you know how many BC and SW stations it supports? Believe it or not, 70. That is a seven and a zero. Seventy. That's not taking into account the military, government and private businesses who have their own networks. The number is staggering. Now mind you, that is only one country. Multiply that to account for *all* the stations in Asia and Africa. The ITU? Oh yes, that's in Geneva, isn't it?

In summation, the over-all picture of the frequency spectrum indicates that control through present administration is no longer effective. The situation will become progressively worse as time goes on. More and more new stations are clamoring for space which is already nonexistent. The countries who are not members of the ITU will use frequencies they deem necessary. The others who are members will agree to the recommendations as long as they are present at the conferences, or if it serves

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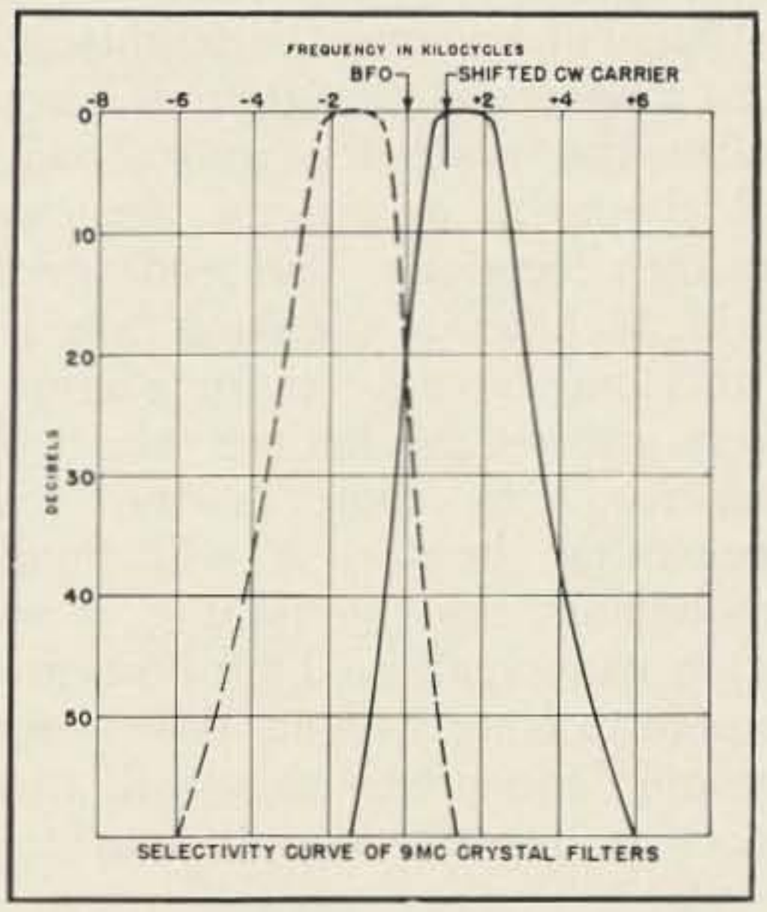

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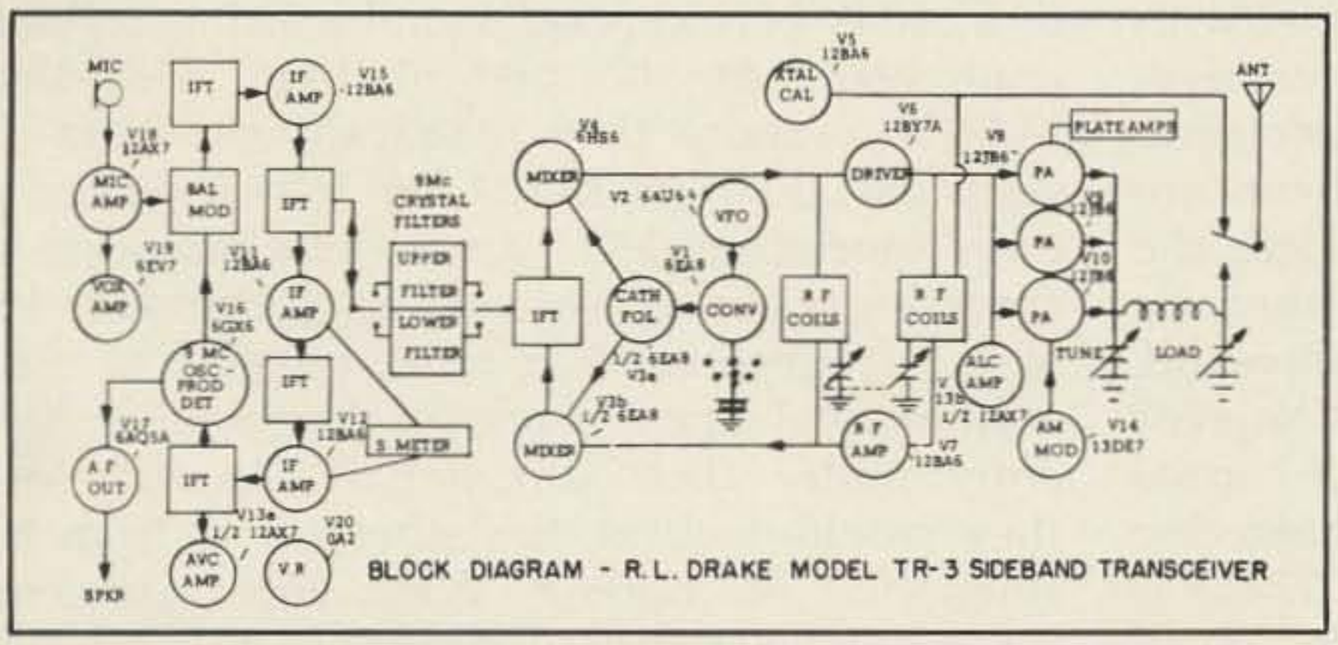

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their purposes. Once they return to their bailiwick, however, they will follow the dictates of necessity. Responsibility will be hard to come by when they feel that they are being detrimental to themselves by abiding by the regulations.

Eventually, the amateur frequencies will be completely taken over. The process has already begun since the last conference and as a portend of things to come, commercial stations are continuing to encroach on the amateur frequencies. When the final encompassing will reach the final phase is a difficult item to peg down. It may be a long drawn-out process, or it may not. It can be anybody's guess. Regardless of the amount of conjecture, it is inevitable. Those of us who shun the idea, or refuse to accept the fact are living in a cocoon.

In time to come, the commercials will create enough of a problem so that the congestion will become thoroughly inhibiting and it no longer can be ignored. They will finally realize the need for control and only then will there be a general agreement for frequency allocations. The leading nations of the world, technically speaking, are already aware of this and have been for a number of years. These are not the nations who will have to be convinced. As soon as the "battle of the megawatts" begins, it will finally dawn on nonchalants that something is wrong. Every nation cannot afford high power, nor will they be able to cope with it. When enough of them become "educated," they will then raise their voices in protest for changes to be brought about.

There has been talk that if the amateur service were abolished there would be a resultant solution to the frequency shortage problem. In my estimation, the only solution it would bring about would be of temporary nature, if any. Any individual who proposes that the present dilemma can be rectified by discontinuing the amateur service, is stating the fact that he is not qualified to contend with the matter. Abolishment of the amateur service is not a logical solution to the problem, and moreover, it never will be. There are many things that can be done to alleviate the problem of frequency shortage. Will they be done? I doubt it. At least not in the foreseeable future. There is the matter of politics, present equipment in use, the huge amounts of capital required to convert to other means, conflicting viewpoints; to mention a few reasons. There is also a matter of an enforcement body which doesn't exist. Parallel to the influence of a well-known amateur organization, the ITU in its present form has worn out its usefulness. It has no power. The entire organization functions on a "gentlemen's agreement" and with the present world situation being what it is, there are fewer and fewer gentlemen.

What does all this mean to the radio amateur? It means that the amateur may have to share frequencies with the commercials. I use the word "may" because it is possible that ham radio may become a historical era. It is quite possible that the United States along with other leading nations will retain the amateur allocations altho the amateur will be forced to operate with the foreign commercials. Then again, we may be forced into the VHF, UHF and the higher frequency bands. It all depends on the whim of our government and the FCC. It is also highly possible that they may scrap us to pacify the foreign governments. This would not be at all surprising, to say the least, when considering the present outlook in a political sense.

I am aware of the fact that I have painted a rather cynical and dismal picture regarding the future of amateur radio and the present state of affairs, but the identifying facets are prominent. As a DXer I cannot see how DXing, as we know it today, can flourish when the avalanche begins. Altho our government may take the open-minded view, there are many governments who will not. Exit the DX station.

Narrowing it down to our own country, we have one salvation the way I see it. Our military. In the event the FCC forsakes us, I sincerely believe that the military will come to our rescue. The reason I believe this is because if there is any agency that recognizes the value of ham radio, the military does. Just ask the United States Navy what they think of the amateur in regard to their operation in the antarctic. Just ask the military what they think of a pool of ready-trained personnel during national emergencies. Where else can they lay hands on personnel for their needs, or the needs of industry manufacturing military equipment. At the present time with their MARS programs they practically give you the shirts off their backs. Many military installations sport complete ham shacks provided by special services. If we experience complete loss of our frequences, it is quite possible that the military will open blocks of frequencies presently under their jurisdiction. Another way they would look at the situation is from the standpoint of training. What finer experience for counter-insurgency work can be had than by operating and moving traffic among high-powered commercial stations. Ask the Special Forces, fellow amateur. I hardly think that

the amateur service will be completely abolished in our country. Not as long as the military has the task of defending our ideals and there are dedicated men in charge of the armed forces.

Getting back to amateur incentive, the amateur is really not the guilty culprit after all. If he is lagging in incentive it may not be of his own making. The framework under which we function is not totally due to the amateur's desire, but to the bureaucracy's. In spite of all this, the amateur has made many contributions to the art and will continue due to his very nature. He is not really behind in achievements when considering that many of his noteworthy achievements were not products of super-educated brains, or multi-million dollar laboratories. In less technical terms, the amateur is continually contributing to international good will by his congenial conversations with amateurs of other nations. Is this a public service? What could be more important in this day and time. What about the amateur's contribution during emergencies where the lack of professional participation is noted by their absence.

I belive we amateurs will take care of our own, as far as incentive is concerned, because it is imperative that we do. If it is too much of a strain, then we ought to turn in our tickets. Many factors have been pointed out in the past that can be improved upon. One of the more important items is the conduct on the part of every amateur. Cooperation during the movement of emergency traffic will have to be increased. There is no excuse for deliberately causing interference during a crucial time. Another important point, is our "image" in the public's eye that could stand a lot of improvement. If we are to survive, then we need all of the help we can muster. As an amateur, make yourself worthy of help.

. . . W4LCY

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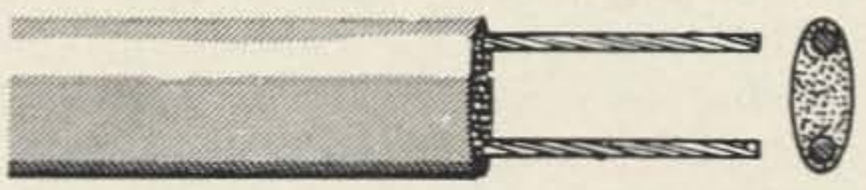

Question: I live in the city and my twinlead not only gets fried by the sun and soaked by our chemically active rain, but gradually gets a hard coating of condensed smog and soot which obviously must affect it. What'll I do? That stuff doesn't come off.

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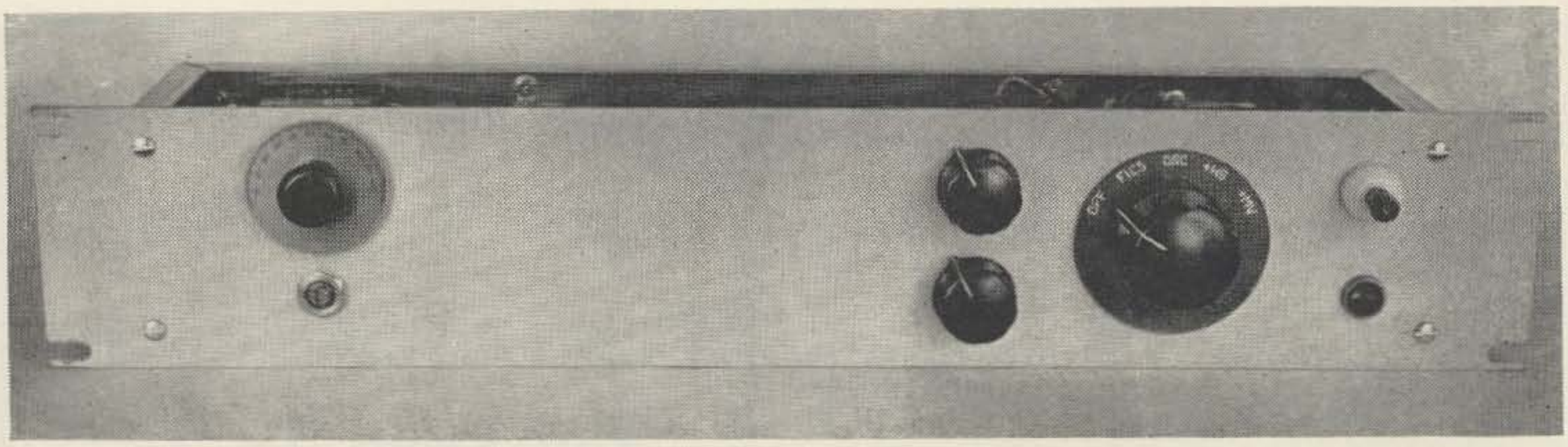
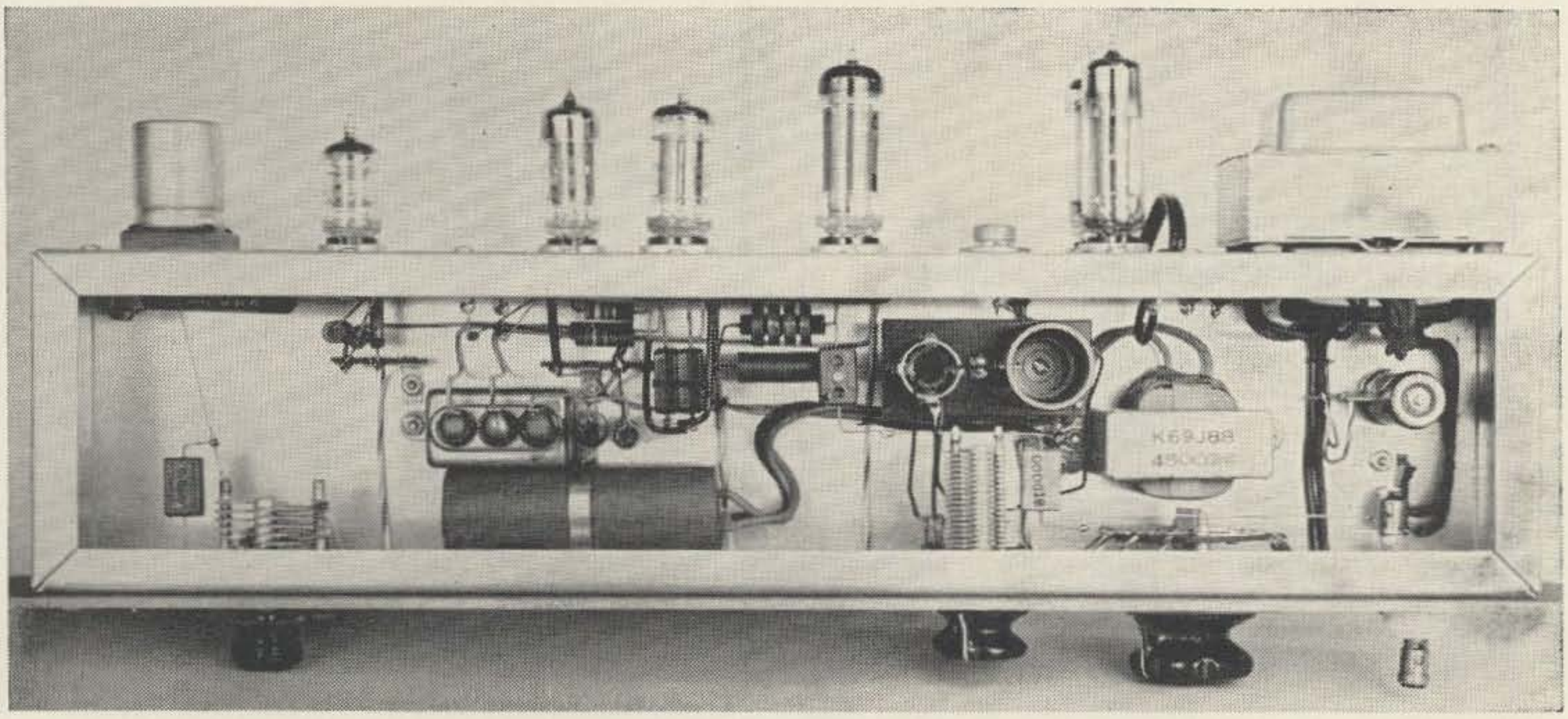
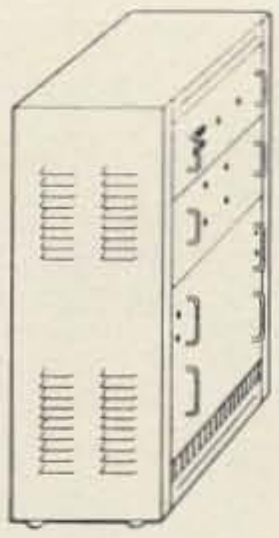


Frequency Standard

Robert McGraw W2LYH
9 Pegs Lane
Riverhead, New York

Some sort of frequency standard is, of course, a necessity in every ham station. The usual 100 kc crystal oscillator, while fulfilling most requirements, can be made much more useful by the addition of a 10 kc multivibrator and harmonic generator. There is nothing like those 10 kc markers for calibrating the dial scale of that new receiver or VFO which you have just built. In several previous frequency standards, I had trouble keeping the multivibrator locked on 10 kc. It seemed that whenever I wanted to use it, the multivibrator was working on 11.111 or 9.090 kc. This difficulty has been eliminated in the present model—the multivibrator stays reliably locked on 10 kc. For dividing the 100 kc by an even integer, in this case 10, the synchronizing voltage should be fed to both multivibrator plates in phase. This is accomplished by the use of the 6C4 buffer tube, which acts as a Heising modulator on the 12AU7 plate supply. The harmonic generator is a 6BA7 pentagrid mixer, which gives excellent isolation of both input grids from each other and from the plate cir-





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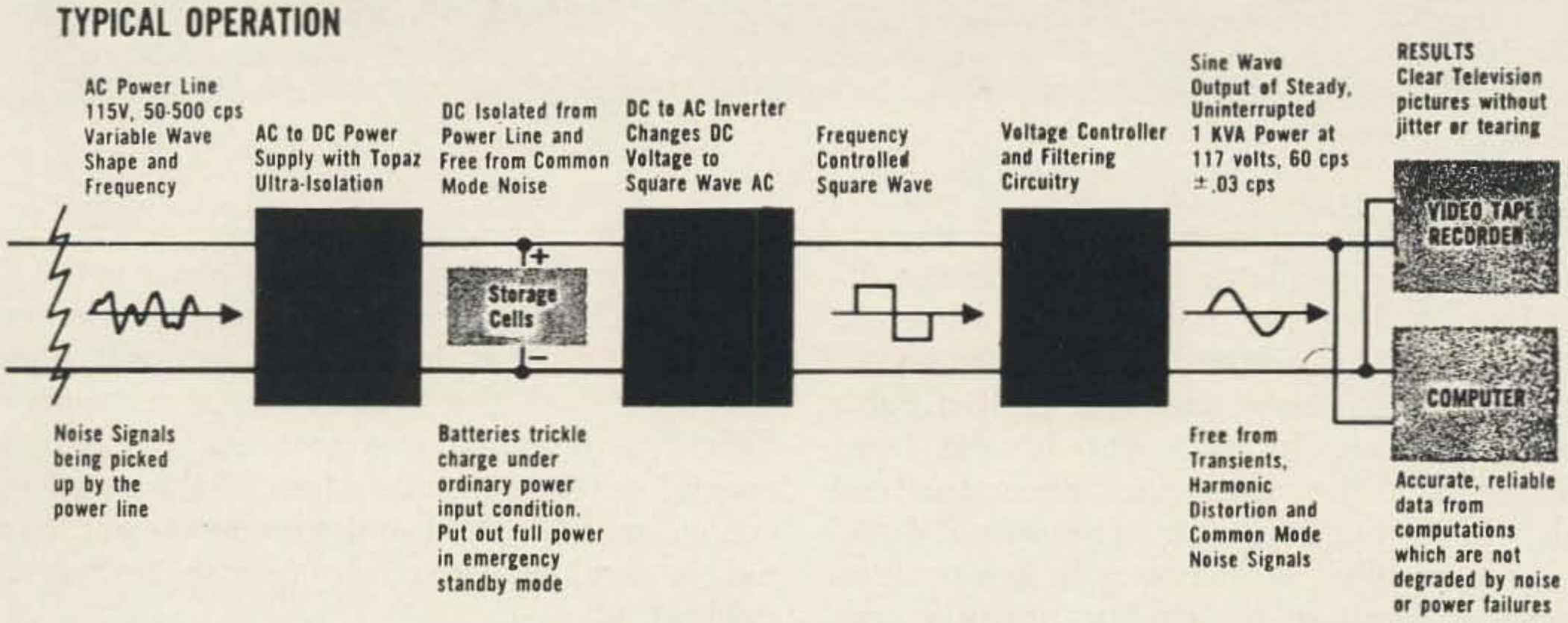
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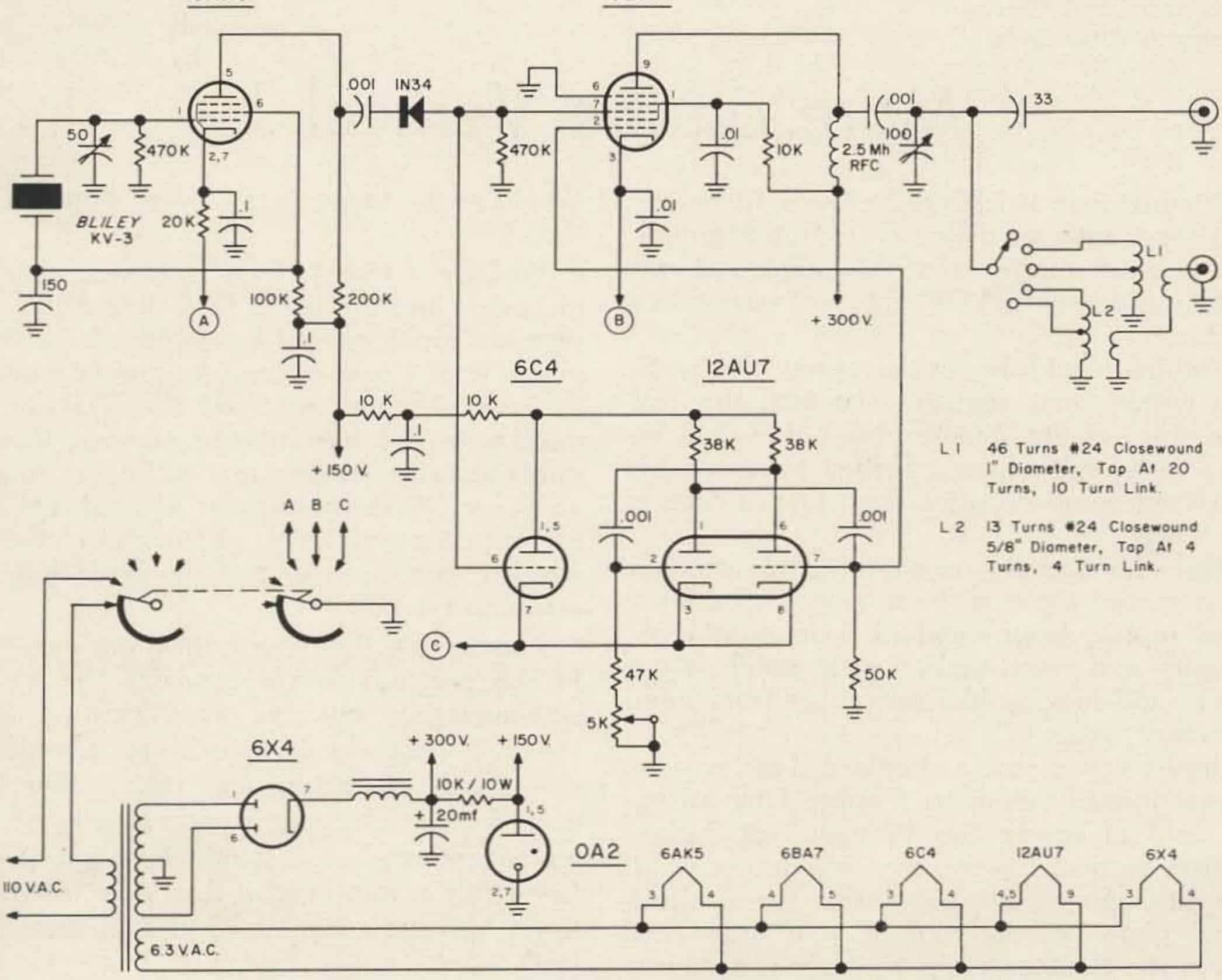
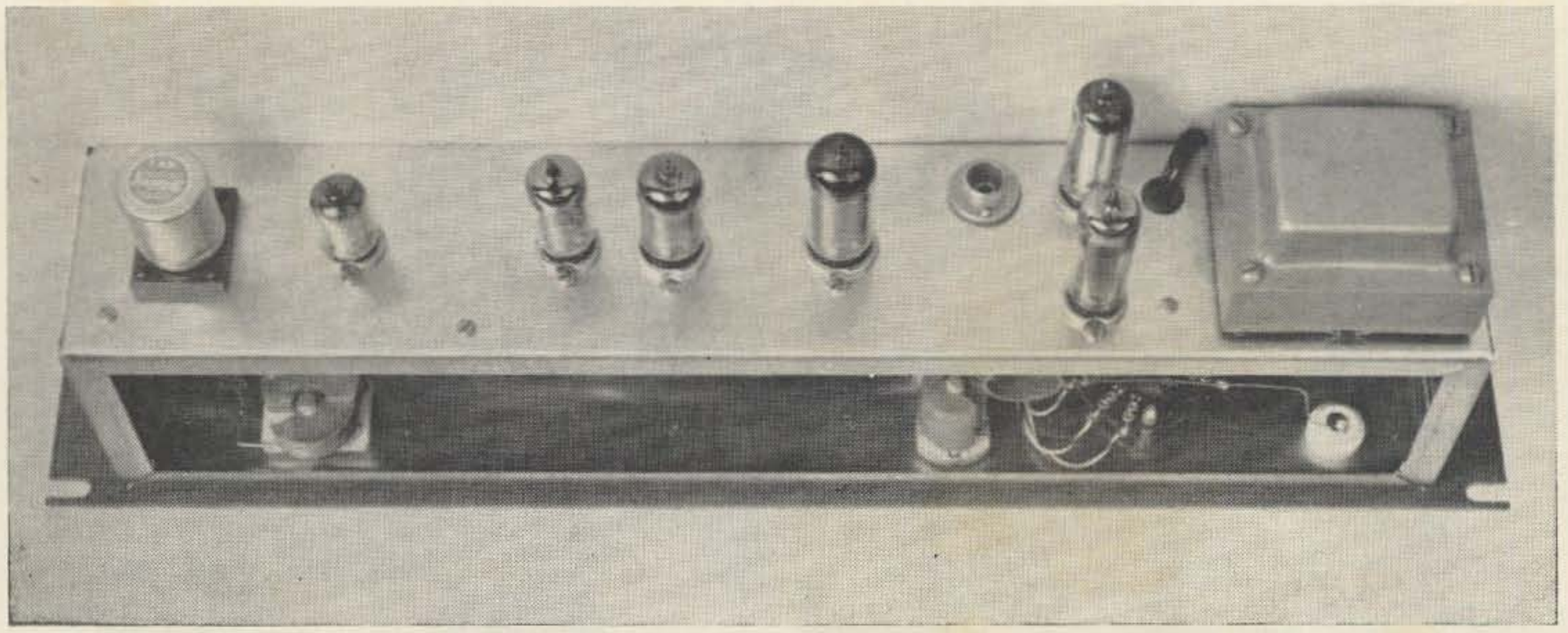


L 1 46 Turns #24 Closewound 1" Diameter, Tap At 20 Turns, 10 Turn Link.

L 2 13 Turns #24 Closewound 5/8" Diameter, Tap At 4 Turns, 4 Turn Link.



cuit, so that the oscillator frequency is not affected by switching the multivibrator on or off, nor by tuning the output circuit. The crystal zero-adjusting trimmer and the multivibrator adjusting pot are brought out to the front panel, as are the harmonic generator coil switch and tuning capacitor. The output functions are controlled by a two-pole five-position progressive shorting switch. In position one, the ac power is off, position two turns on the filaments, position three turns on the oscillator, and positions four and five cut in the harmonic generator and the multivibrator respectively. The low-impedance output is fed into the coaxial antenna input system of the station receiver, and the high-impedance output terminal is used for general purpose testing and calibrating.

Jim Kyle K5JKX
1236 N.E. 44th St.
Oklahoma City, Okla.

More on the Vertical J

Our previous article on the "so old it's new" Vertical J antenna may have left the impression in some quarters that this quick and easy (also inexpensive) VHF antenna was strictly for Six.

Nothing could be farther from the truth. The writer's first acquaintance with this skywire was on the 2-meter band during a sojourn in 6-land, where it helped provide fairly consistent communication from Los Angeles to San Diego.

And the 2-meter version of this antenna bears special mention, because it can be fabricated rapidly from standard commercial components—and even used on your mobile if you don't mind looking like something from interplanetary space.

Because, you see, a standard 6-meter whip is exceptionally close to ¾ wave long at 144 mc, and of course the 19 inch "catwhisker" rooftop vertical for two is a quarter wave. If you just mount the catwhisker on a sheet-metal plate (or the roof of your auto) and fasten the 6-meter whip an inch or so away, you have the beginnings of your 2-meter Vertical J.

To have a true J, both antennas should be grounded and the balun feed described in the previous article should be employed. However, many West Coast enthusiasts ground only the ¾ wave element and feed the ¼ wave catwhisker in the conventional manner; they report no noticeable degradation in performance, and any SWR problem is cleared up in a few minutes with dykes at the end of the catwhisker. Not according to the book, but they say it works FB!

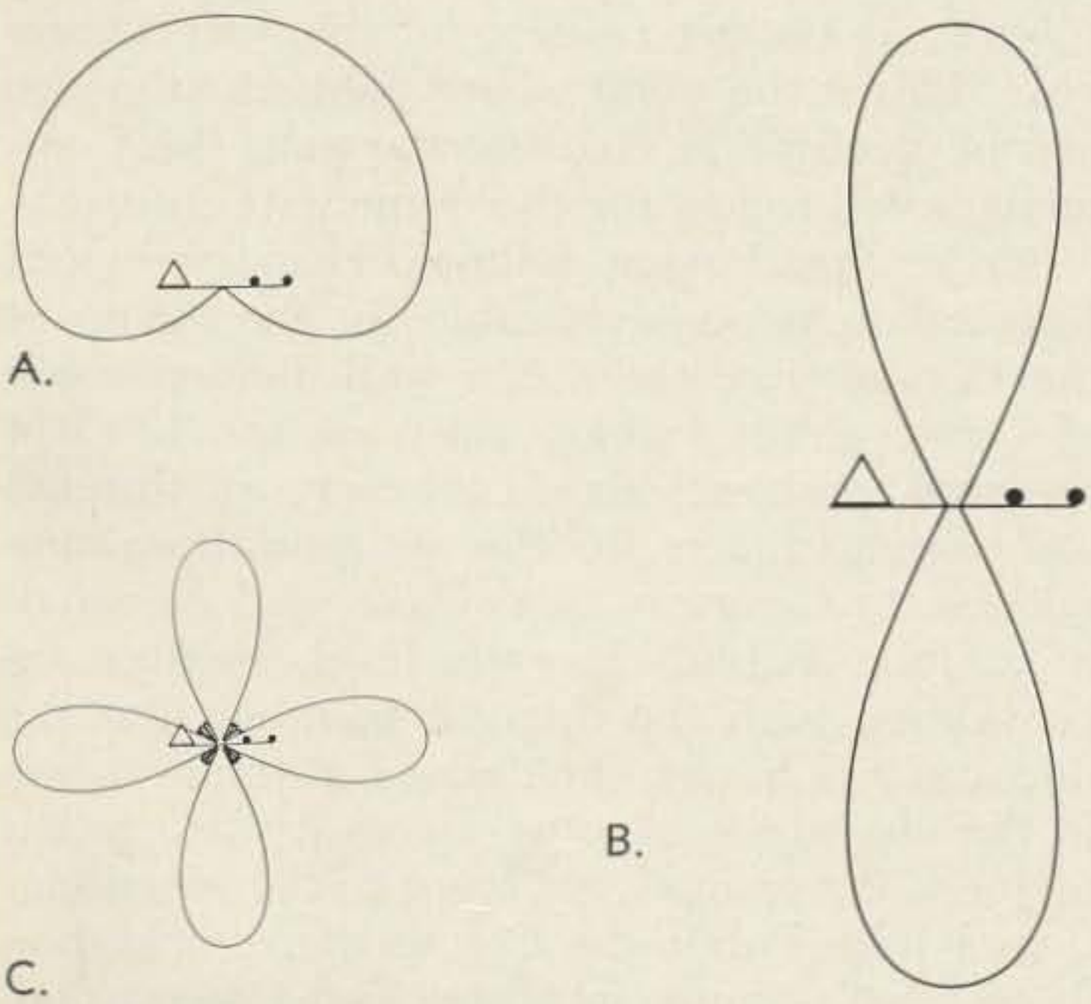
Another possibility with the J not mentioned in the previous article concerns the idea of side-mounting one on your existing beam tower. If properly done, this can provide you directional characteristics (this, admitterly, overpowers a characteristic previously cited as an advantage—but a good cloverleaf pattern frequently is more useful than a perfect circle, if you can get a few db of gain in the cloverleaf).

Three patterns are available: cardoid, bi-directional, and cloverleaf. The cardoid pattern is achieved by mounting the antenna ⅛ wavelength away from the tower. The null will be on the line running through both tower and antenna, on the side of the tower. The bi-directional pattern (a rather sharp one, by the way) is achieved with a ¼ wave spacing. The lobes will be at right angles to the line running through both tower and antenna, and will be of approximately equal strength.

The cloverleaf pattern occurs with half-wave spacing between tower and antenna, with one lobe spotted on top of each of the lobes of the bi-directional case, and the other two lobes halfway between. The nulls of this pattern are usually not very deep, making it the most useful in many cases.

These three patterns are sketched in Fig 1, not to scale. For the benefit of the technically inclined, here's what happens. The tower is a metallic object (if it's not, this trick won't work) and is sufficiently long that we can consider it not to be resonant. To a surprising degree, it acts like a metal reflector, producing an effective "image antenna" on the other side. This "image antenna" then combines with the actual J to produce a 2-element broadside array, and the patterns cited are determined by the spacing between the elements of this "array." Sounds screwy but it works out in practice, and is widely used by the commercials operating in the VHF and UHF regions to avoid the purchase of beam antennas when they need directionality!

. . . K5JKX



A. ⅛ wavelength spacing from tower
B. ¼ wavelength spacing from tower
C. ½ wavelength spacing from tower

Side-mounting Antenna Patterns, not to scale.

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Big Brother, and How he Grew

(or House of Seven Gables, Ham Version)

Milt de Reyna K4ZJF

Throughout the RM-499 ruckus, one fact has become increasingly evident; simply, it is this: probably in no other field do advocates of the art know as little about their governing body as do Amateurs, as a group, about the FCC. Though this agency holds the power of life and death over Amateur Radio, not one ham in a thousand knows enough about it to carry on any sort of a discussion concerning the Commission's operations—and you can't really blame the average ham for this sad state of affairs, for amateur publications have never attempted to publish any sort of a primer on the FCC. A searching analysis of the Federal Communications Commission would, at this point, require the better part of a year to compile— but a ready working knowledge shouldn't be too difficult to acquire; this article hopes to provide a start. First, however, let's try to provide a few ground rules that will help writer and reader understand each other, to wit: the writer pretends no claim to amateur fame, and doesn't intend to lecture anyone on what should be done. However, he has worked for fourteen years in commercial broadcasting, and has had to learn to live with the FCC; this experience just might provide you with an insight to what is going on that may be worth having. The reader's part of this agreement will involve his doing two things—first he will read the comments on Ivan Loucks in Wayne's February Editorial, then he will turn to page 81 of the same 73 and read the essence of Ivan's mesage in Bill Orr's letter. He will memorize what Mr. Loucks has to say about the apparent confusion between personal and public interest, and will stare in awe at the term 'problem children'; he will read the last sentence concerning the standard against which the wisdom of continuing our allocations will be measured, and then he will try to learn something about the agency which will make the measurement, which brings us to the start of this article.

The Federal Communications Commission was created by the Communications Act of 1934; it's purpose is simply to regulate in the field of communications, whether they be by wire or radio. It is an arm of and is responsible to the Congress—it is most definitely not a Presidential Advisory Committee, or anything of that sort. The Commissioners themselves are nominated by the President, but are subject to confirmation by the Senate. Most important is this one fact—theoretically, the Commission is not subject to political influence on any one matter, or conflict that comes before it for disposition. In other words, your friendly Congressman just might do you more harm than good if he tries to pressure the Commission on the matter you have before it; and decisions that can be shown to have been involved with undue influence are subject to overturn at any time. However, the policies and guidelines the Commission uses are very definitely subject to revue by Congress—yearly, when the agency submits its budget request for the forthcoming year. This is the point where political influence can be decisive in charting the path the Commission will follow for the immediate future.

As you read what follows, keep one word foremost in mind—defensible. In the set up of the Commission, there is a well defined chain of responsibility, which starts at the level of the staff, and extends all the way up through the Commissioners, to the appropriation committees, to Congress as a whole, and eventually to John Public. At each level, matters are considered with the thought in mind that the decision will have to be defined at the next link in the chain, the eventual necessity being that of Joe Congressman justifying to the aforementioned John Public the Commission's operation during Joe's tenure in office. The Commission, therefore, is never going to hand Joe a decision that cannot be justified as being in the public interest—the majority must always be served (there's better than 180,000,000 of them and

250,000 of us; remember that, too).

In the pre-war years, the Commission's basic responsibility was the encouragement of the providing of communications facilities to the public; from its inception until approximately 1947, the Commission was basically a passive regulatory agency; it ruled on matters brought before it, but it made no attempt to lead the broadcast or commercial communications industries in any particular directions, preferring to let the normal needs of the marketplace be the central determining factor in the goals that were to be set.

The end of the war marked the appearance of an entirely new set of circumstances, and resultant pressures, from what the Commission had ever before encountered. AM broadcasting boomed, there were more applications for new stations than the Commission knew what to do with; and, some interesting, albeit prohibitively expensive experiments with black boxes that made pictures were beginning to present some most interesting problems.

AM frequencies have always been controlled by supply and demand; it was the applicant's responsibility to determine whether he wanted to apply for a local, regional, or clear channel frequency; to produce the necessary engineering studies to prove that the new facility could be built without representing serious damage to the service areas of operating facilities, and to show that the new facility would represent a service to some segment of the population living in the area in which it proposed to operate. When all these criteria were met, the applicant could reasonably expect a Construction Permit to be issued.

At first, television was to be handled on the same basis; but, the changes later produced by the impact of Television, which are still having their effects today, are the real meat of this article, and will render a pretty fair picture of general Commission thinking.

At first, the Commission set up three classes of Television Stations—Local, Regional, and Rural with service areas that are obvious—and planned to let the laws of supply and demand take care of how many stations would wind up where. But, they did not reckon with the impact that TV would produce and the resulting fantastic demand for frequencies in large metropolitan areas, nor did they reckon with some unsuspected defects in paper engineering and the profusion with which Old Sol produced in the maxima of 1948. The result was a freeze on TV construction permits which was to last until 1952—there were 108 TV stations either operating, or under construction at the time the freeze was imposed. The purpose of the freeze was to allow time for further research to find ways to avoid the serious interference problem, and to study posible methods of frequency allocation, which would provide the best possible service to the maximum number of people.

During this period, the Commission was subjected, rightfully, to all sorts of demands from the elected representatives of areas that did not have operating TV stations to end the freeze; meanwhile, the impact of TV became obvious, and all sorts of interested lobbies showed up asking to be heard. The educational interests made the loudest noise, and the CBS-NBC battle over whose standards would be accepted for color ran second only by a snoot. The result of all of this was a radical departure by the FCC from prior standards, and the adoption of allocation tables and an "everyone is equal" philosophy. (Does this sound familiar). Maximum operating conditions were

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assigned to Channels 2-6 and 7-13 that attempted to make the service areas of each equal; the newly opened UHF channels were assigned maxima of 1,000,000 watts hoping to make them competitive with the VHF facilities. Prospective licensees were given time to prepare their applications, and standards for deciding competing applications for the same channel were enlarged and redefined. All of the above detail is set down to give the reader a good idea of just how rough a spot the Commission was on, and on the type of solutions that were proposed to form the most painless solutions. The competition for the Channels was fierce, and the pressure from the public to get, at least, some of them operating immediately was worse; the Commission was caught right square in the middle, and it emerged in the late fifties as an entirely different breed of horse from what it was when it first entered the TV arena. What was once an obscure small agency, was now the center of attraction; everybody knew there was an FCC, it had something to do with television, and would it please stop fooling around and get Back Bay's channel on the air.

Television grew in alarming steps, and knotty regulatory problems, in addition to competitive hearings, grew with it; as it became involved in one crisis after another, the Commission became more of a Crusader for the creation of new Public Services than a Protector of the conventional areas of Public Interest—this was later called the New Frontier. Gradually, the Commission began to chart new courses into areas that had never before been its concern—type and source of programming, sales practices, etc., all have come in for their share of attention. It was inevitable that the Commission should eventually incur the wrath of Congress, and start procedings looking toward the limits of the area in which Congress intended for the FCC to act. To go further would get into speculation and assumption, warranted or otherwise, which are areas we agreed are out of bounds for me. So lets sum up what we now know about the FCC, and then devote a few moments to projecting this new posture of the FCC into the middle of the chaotic situation that is Amateur Radio today.

We now know, I think, the following:

1) The FCC is today a vibrant agency that has defined clearly what it thinks is its mission. It has moved far enough towards the area of Public Utility regulation that there is now a serious move within Congress to accurately define the limits of the FCC sphere of decision.

2) The agency is almost fearless in moving to correct what it thinks are abuses in areas where there is no question of its authority to regulate. Within the last six months, the FCC has revoked, for cause, many licenses, one being an AM Broadcast that was worth over $1,000,000. The former licensees of this station lost over $900,000 in the revocation, and you just can't minimize the seriousness of a penalty of this sort. The action speaks eloquently for itself.

3) Television is getting most of the attention today for the simple reason that the Commission considers this the greatest area of need, and the greatest area of possible reward. It's easy to throw all sorts of mud in this area of motivation—by all means draw your own conclusion on whether these men are motivated primarily by laudable ideas of public service, or not so praiseworthy purposes of personal publicity—but, accept my assurance that these ideas and methods will one day get around to ham radio. (Go back and read Mr. Loucks' last sentence again). Frankly, I hope you're fairly well shaken at the moment; I hope you're wondering where the hell we go from here. Stop and think—the average family spends about eight hours a day in front of the idiot box;there's no question but that TV today provides the bulk of the average man's entertainment, yet, the FCC has not hesitated to tackle problems that go to the very root of the institution of commercial television as we know it. They are dealing with the basic entertainment of over 180,000,000 people—an industry whose size goes into billions, and not even the Commission's worst enemy will accuse it of being gutless. Idiotic maybe, but not cowardly. Now, in that context, just how important do you suppose our earthshaking little squabble about incentive licensing.

Since you're drawing the conclusions, let me ask the questions—

1) Realizing what the justication for the existence of amateur radio is, how do you suppose the FCC is going to react to the thousands of letter it has received damning the ARRL for the incentive proposal because of contrary personal interest. These things usually start by saying "The ARRL certainly wasn't acting for me when they filed. . . ." Mr. Loucks had already had, obviously, a pretty good dose of this when he made the QCWA speech. How do you suppose he feels now?

2) Has this squabble soured the Commission on the ARRL, and raised serious questions on its credentials as Ham Radio's spokesman? Regardless of what it thinks about RM-499, does the Commission consider the way the petition was handled with the result-

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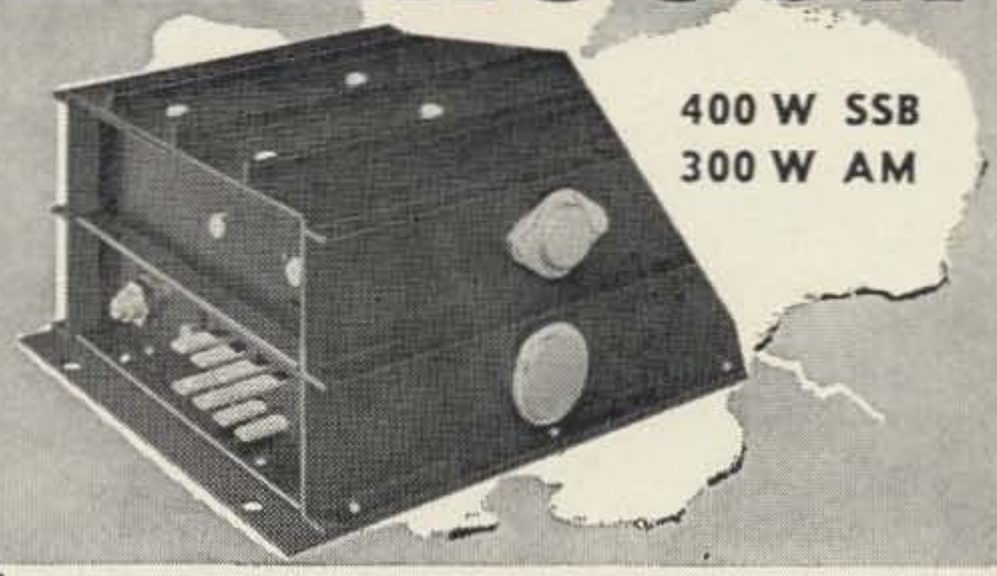

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ant controversy as being prima facie evidence that the League is not all it says it is? If true, will the Commission seriously question whether the ARRL will still command enough prestige and repect to keep Amateur Public Service projects glued togther, or will the FCC get into this area itself? Are we likely to encounter more interest from the FCC in the future as to just how much of our operating time each of us devotes to Public Service? Will we have to file a Public Service narrative and a list of the organizations to which we belong along with our next license renewal.

3) Especially in view of the emergence of the Citizen's Band, do we need a lobby in Washington? Had we better see that each elected Senator and Representative gets a running monthly commentary on the Amateur contributions to Public Welfare made in his district in the past thitry days? Would we like to have the House Appropriations Subcommittee express concern, at the annual budget hearings, to the Chairman of the FCC about his plans to enhance the Amateur Service during the coming year.

4) Finally, do we have every reason to expect that the FCC is liable to step into the current breech with rulemaking proceedings of its own, which may make the ARRL's proposal look like kindergarten poetry? Have we divided our own house and become prey not only to commercial interests but even to the Citizen's Banders?

We need leaders; we need men who, out of the current conflict, can construct a simple brick house that no wolf can blow down. We need to stop selling each other on our record of Public Service, and take that record to someone who can do something for us. Maybe Wayne's new IoAR is the answer; maybe this can all be straightened out inside the ARRL. Certainly, we'd all better calm down, and quit thinking about only our own interests. and devote some thought to how best to do the things Ham Radio needs done.

Immediately above Mr. Loucks' comments in the February 73, page 81, there is the end of a fine article by Dana Griffen; probably, like me, agree with some of the things he says, disagree with others—but, this last paragraph is a pip, isn't it? How about 1296.5234mc, our lowest frequency band, on January 26, 1970, at 1430 GMT? Should be a wonderful round table.

. . . K4ZJF

Eric Young K7KYG
Kent, Washington

Amateur Radio Emergency Service

Yeoman service was performed by radio amateurs in the recent earthquake disaster in Alaska. A number of Alaskan amateurs worked long hours without respite to clear outgoing messages to relatives of people living in areas affected by the earthquake. They were not helped by some thoughtless hams in other parts of the U. S. who kept trying to QSO. One ham (WB6FRM) even tried to QSO with CW on the SSB frequency. Most, if not all, of the traffic was cleared on SSB. Monitoring the CW segment of the 20-meter band showed no KL7's clearing traffic, but a number of amateurs busy with the DX CW contest sponsored by the ARRL.

Of note was the length of time required to transmit each message on phone, in spite of the fact that ARRL message numbers were used instead of text. Much time was taken for spelling out of names of addressees, streets, and towns using phonetics. There was also need for frequent repetition in the case of street and telephone numbers.

Assuming that an operator can transmit reasonably good morse code at speeds around twently words a minute, it should be possible to clear mesages of the ARRL number type at a rate of fifty or sixty mesages per hour. It would have neded only half-a-dozen good operators to handle both outgoing and incoming traffic over the week-end. As things were, very few incoming messages were accepted by the Alaska amateurs on Saturday and Sunday.

Amateurs in general should learn some lessons from this disaster. Fortunately, comparatively few people lost their lives and the number of injured was small. This could have been due in some part to the small size of the affected towns. BUT let us suppose that a city such as San Francisco were the center of an earthquake of similar proportions. With power lines down, no telephones operating, water and gas mains broken, and sewers out of service; hotels, apartment houses, dwellings, and office buildings demolished; streets cracked and warped, and numerous casualties; could the San Francisco amateurs carry out an emergency communications operation? Just imagine the colossal number of messages that would need to be handled.

Supposing that a sufficient number of amateurs were equipped with gasoline powered generators (and supplies of gasoline—the gas pumps don't operate without ac supply) just how many stations could be accomodated on the phone segment of any band, even if all were working SSB and assuming that no thoughtless or inconsiderate hams in other parts of the country were attempting to make QSO's (or maybe a DX 'phone contest might be in progress)? One can imagine that there would be a H--l of a mess! UNLESS some kind of control can be worked out in advance ready to be put into effect under emergency conditions.

It is true that we have ARRL Section Communications Managers and Emergency Coordinators right now, *but* I have my doubts as to whether any EC has ever been given instructions as to his duties and responsibilities. The average ham doesn't know who is authorized to handle emergency communications in his area or what action he should take in the event of a local disaster.

These matters require immediate action—*the next earthquake may not wait too long before it strikes. It may be S.F., L. A., OR N. Y.* Who knows?

. . . K7KYG

Correspondence from the Members

Letters we bet you won't see in QST

Dear O. M.:

I would imagine that as manager of the ARRL, you participate in and bear a large portion of the responsibility for determining League policy; as such, RM-499 must be a result to a great extent of your thinking—considering the chaos sired by your brainchild in the past six months, do you not feel just a bit foolhardy in commenting on that thought processes of someone else? Again, assuming that the current posture of the League is largely your creation, do you know of anyone with less license than yourself to characterize another as "irresponsible"? Have you not mistaken your pinafore for a toga, or are you prepared to compound your position by claiming that you anticipated the bitter situation that has resulted?

I'm sorry you learned nothing from reading my letter three times; you're the first I've run across who had to read it more than once to get the message. It is true that the only answer to that letter would have been a detailed retort to the direct questions raised—your epistle of Feb. 25th begs the issues in the same manner Mr. Hoover did; we can play ring around the rosy for the next month, but I'll be damned if you're going to outlast me by answering questions other than the ones I asked. Let's try to reduce the issues to simple statements, and see what happens then:

First, I agree with everything the League has said about Incentive Licensing; I also believe you are honest in claiming that about half of ARRL's members support the concept. I am diametrically opposed to the ARRL plan; I have heard many others which would achieve an Incentive Licensing structure through a, seemingly, more logical, more palatable and less dangerous course; the broad outline of a couple of these plans is included in my last letter—what I asked for was an analysis of why the ARRL plan is better than the ones I referred to. You have replied with a reference to your defense of the concept of Incentive Licensing; Mr. Hoover used the same tack—in a Court of Law. you'd both be ruled out of order for producing answers that are not responsive to the question; however, since we have no such authority as a judge handy at the monment, I suppose we can waltz each other around until one of us drops from exhaustion. Why is the ARRL plan better than any of many others that would achieve the end of setting aside portions of the bands we now have for Advanced Licensing, and would leave, at least, some room for current Generals to continue phone operation on all bands? Now, don't reply to that question by launching into a defense of Incentive Licensing; don't cloud the issue with nonsence about lousy signals, public service, ITU, IARU, allocations conferences, etc., all of which may be problems, but they are not germane to the matter in question. Assuming that Incentive Licensing is to be desired, WHY IS THE PLAN THE BEST? WHY DID YOU SETTLE ON A PLAN THAT WOULD REMOVE ALL INSTEAD OF A PORTION OF PHONE FREQUENCIES FOR GENERAL TICKET HOLDERS? This is what I referred to in my last letter by asking for the origin of and reasoning behind the ARRL plan; neither you nor Mr. Hoover has yet provided anything on the plan itself that is worth the cost of the paper its written on; this is the issue you have consistently avoided, and the one you won't come to grips with now. Again, you are being asked to defend ARRL's plan for establishing an Incentive Licensing structure—you are not being asked to defend the concept of Incentive Licensing.

Now, let's try to add one more thought; personally, I don't believe I'm competent to render a truly meaningful judgment on which plan is best, for I'm simply not in possession of enough information; though I'm opposed to your plan because of the severe hardship it would work on many licensees, I'm aware that there may be cogent reasons arguing for the acceptance of your plan—these reasons are what I've spent the first four paragraphs asking for. However, I do feel qualified to make the judgment that you have botched your program beyond all reason; no entity that engages in commerce of any kind with the Federal Government would never knowingly create a problem within its ranks and then ask the government to solve it. You've done this, either by intent or accident, and you haven't sense enough to understand yet the position Amateur Radio is left in because of your miscalculations. I believe that unless you can cure the dissension in the ranks, you may have outlived your usefullness; based on current FCC thinking, I don't think it is going to be too interested to exert the firm leadership you asked for, which was merely a thinly disguised plea for this agency to fish your chestnuts out of the fire for you. Are there any answers to these questions—can you justify your current posture, or are you going to reply by telling us all about hundreds of problems that have nothing to do with this one.

Regarding your comment about my letter to you being published in 73, this was as much of a surprise to me as was Wayne's original quotation of my remarks in his February issue; he was certainly within his rights to use them, but they were not originally written for that purpose. However, when you challenged me on the basis of something I said months ago before you drove your latest bull through the china closet, I had no choice but to let him know what was going on—I could not take a chance of embarrassing him by leaving him in a position where he could be caught short on information. And, since we're discussing his irresponsibility as well as mine—and yours—he ought to have a copy of this also. He may be off base in a couple spots, but, I'm beginning to think his overall ideas are correct—and, his suggestions for reorganizing the League seem to me to be pure genius.

Milt de Reyna, Jr., K4ZJF
Pensacola, Fla.

Mr. Richard Baldwin W1IKE
Assistant General Manager
American Radio Relay League
Newington, Connecticut
Mr. Baldwin,

I have your letter of February 25th and resent it greatly.

In the first place you are making an assumption that anyone who disagrees with you feels ". . . that their own personal ox is being gored." Whereas if you had payed the courtesy of reading my correspondence regarding my resigning from ARRL you would have noted that it was because of ethical considerations.

My resignation occurred because I thought ARRL was not loyal. Reversing "The Amateur's Code" momentarily, "The ARRL owes its existence to the Amateurs and offers them unswerving loyalty." This, Mr. Baldwin, is the other side of the coin. There is no such thing as one-way loyalty. Loyalty is reciprocal moving in both directions for mutual reinforcement. Without loyalty from the League, there is none due it.

This lack of loyalty on the part of the league was shown not by others but by the July 1963 editorial in QST. To avoid misquoting I am gving the entire paragraph—

> *" 'I thought the league was supposed to represent my interests.' It does, but the best interests of over-all amateur radio are not necessarily the immediate personal interests of each individual. Over the years, the ARRL Board has taken a number of actions which were unpopular with many members at the time, but which proved to be the wise course."*

As I read this paragraph, I believe the crux of the matter lies in the word -'represent" which ARRL is reading in one

of the lesser accepted connotations rather than the more common one intended. In other words the answer is not a true answer but a changing of the question to a "strawman" question and then answering the altered question. "Webster's New World Dictionary of the American Language" College Edition, 1956, p. 235 lists the following definitions and I would call your attention to the fact that the preferred definitions have a lower numerical order. (Italics are shown by underlining.)

"1. To present or picture to the mind. 2 a) To present a likeness or image of; portray; depict. b) to be a likeness or image of, as a picture or statute is. 3. To present in words; describe, state, or set forth; often to do so forcibly or earnestly, so as to influence action, persuade hearers, make effective protest, etc. as, he represented *the war as already lost. 4 a) To be a sign for; stand for; denote; designate; symbolize; as x* represents *the unknown. b) to denote or express by symbols, characters, etc.; as* represent *mathematical quantities by letters. 5. To be the equivalent of; correspond to, as in a different place or time; as a cave represented home to these people. 6 a) To present, produce, or perform (a play, etc.). b) to play the part of; impersonate (a character), as in a dream. 7. To act or stand in place of; be an agent, proxy, or substitute for. 8. To speak out and act for by duly conferred authority, as an ambassador for his country or a legislator for his constituents. 9. To serve as a specimen, example, type, or instance of, exemplify or typify."*

The person who objected, probably was using one of the earlier more common definitions whereas in your answer you used either the 3rd of the 8th one.

For the moment let us consider the 8th definition, leaving the third till later. In one of my letters, which apparently was not read, I pointed out that legislators are interested in what their constituency thinks. In fact I enclosed a copy of one legislator's attempt to find out. I think, also, it is customary for ambassadors to wire, phone or find out by some means how they shall represent their country.

In the FCC petition ARRL claimed to represent amateur radio or rather the amateurs. Any ambassador who was not certain that he was expressing the wishes of his country, or a legislator expressing the wishes of his public would certainly back away and take another look at this proposed course of action. At least I hope he would—I would hate to think that our Moscow representative might plunge us into war because of a foolish error on his part, particularly when advised he was not expressing the desire of the country. I do not feel I am getting the type of representation I wish so, rather than back a point of view quite alien to my own and not having other recourse within the League, the only ethica thing for me to do is to resign.

Now I should like to point out that if I represented the ARRL view as only the 8th definition, I would be fulfilling the third definition and I would be representing the league in this sense. This type of action both of us would agree was quite unfair representation, yet if this is the definitiion under which the league is taking action, at least I think it is unfair representation. Those who object to the action get the ". . . that their own personal ox is being gored." treatment. The same sentiment of calling the opposition nasty names was used in that same July editorial ". . . the immediate personal interests of each individual." The implication here is that the opposition is a selfish fool. He certainly does not know as much as the wiser ARRL Board. The phrase ". . . but which proved to be the wise course." implies also here is some outside criterion (beyond the judgment of those who decided) that determines this wisdom. The criterion source is not mentioned and it is rather difficult for people who have made a decision not to pat themselses on their backs and say how good it is. . . . .

Now let us take a look at ". . . but the best interests of over-all amateur radio . . ." It would seem to be the responsibility of any organization to draw the members into closer agreement, to lead them and create unity instead of disunity. The action of ARRL has created more disunity in the membership than any other thing within amateur radio during recent times. THE EASIEST WAY TO LOSE SUPPORT FROM OUTSIDERS, WHETHER GOVERNMENTAL OR INTERNATIONAL, IS TO PRESENT A DIVIDED FRONT. Mr. Baldwin, this is exactly what the League has done. It has split amateur radio when we most need a solid front. Our losses in future conferences are apt to be due more to this factor that ARRL has caused than to any technical skill which might or might not be increased by such a plan. If you think the above is an overstatement, just ask someone who has done lobbying, whether the unity of the group of their technical skills are more important in getting legislaion moving and approved. If you do no know a lobbyist ask a legislator. The question the legislator must face (particularly where there is outside opposition, is, should be support one faction or another? The usual response is that if the group members can't agree among themselves they do not deserve support from others.

I was somewhat surprised to see in your letter that you considered incenive licensing a step forward. I seem to remember something similar in the '30's though I was not a ham then. I have a nice new shiny call but I cut my teeth in radio on "Practical Wireless Telegraphy" by Elmer E. Bucher, Wireless Press, 1921 and "The Wireless Experimenter's Manual" by Elmer E. Bucher, Wireless Press, 1920 when they were new books—and I still have them. I still have an affection for Mother's Oats Cartons and Variocouplers. I have read a few more books too. I am not afraid of new theory examinations and I'd be willing to take them too without any preparation. I do strongly resent though the loss of privileges of a large group through the action of a possible minority group. I think there is an ethical problem here which does not seem to have been considered by ARRL. I think the important problem is not, as you say, "maintaining the pace" but the ethical one mentioned above.

As I said in the opening sentence, I greatly resent your letter. Not onily do I resent the name calling but I resent the part that reads "If we weed out all the extraneous comment, if we disregard all the side issues and red herrings that have been dragged across the trail, we find there is one basic goal which amateur radio must *achieve—. . . ." You are implying that the opposition is resorting to distortion and distraction if not actually being dishonest. The purpose is to detract from ARRL's proposal. I should like to point out these implications do not seem very gentlemanly, they impute bad motives to the opposition. Incidentally, in "The Amateur's Code" have you noticed the phrase "He never knowingly uses the air for his own amusement in such a way as to lessen the pleasure of others."? I think it becomes very interesting if we substitute ARRL for "he." . . A third reason for resenting your letter, Mr. Baldwin, is the very basic philosophy which is expressed. The concept that the few know so much more what is good for the majority than those who make up the majority is quite a long way from the basic philosophy of the United States which holds to the different point of view that—the will of the majority determines elections, determines issues in initiative, legislatures, committees and throughout our society. When the ARRL takes the stand it will not consult its members wishes, even where there is reasonable doubt considering the wisdom of their stand, then it is not following a democratic method.*

I really would have preferred not to write this type of letter, Mr. Baldwin, but one such as yours cannot go unanswered without concurring with your comments and I definitely do not concur. A letter such as yours is very ready to place the blame for the consequences of the League's action elsewhere. It blames everyone who gets in the ARRL's way. The opposition is not trying to use a red herring tehnique as you say, but is examining some issues which seem to be real—fully as real as the necessity for incentive licensing seems to some. To say the average amateur does not know what is good for himself is a pretty serious indictment, paricularly when it goes along with implied name calling and impied low motives.

Richard H. Earhart K7NTE

Editor(s) of QST,

I am writing to protest what has recently become obvious even to a novice, namely your flagrant disregard for honesty, sportsmanship and good taste in your handling of the controversy over RM499. Please note, I am not calling this a controversy over incentive licensing. In my opinion it is not—and this is the first point on which

you are less than honest with your readers and members. Many of us (myself included) favor other incentive licensing plans, but think this RM 499 has too many disadvantages—including emotionalism stirred up by ARRL's method of presenting it.

Your misrepresentation of the basis for much of the opposition to RM 499, besides dishonestly representing the opinions of your correspondents, is dishonest and unsportsmanlike in that it eliminates all possibility for discussion in QST of other proposals for incentive licensing. I would, myself, prefer some variation of the widely-discussed plan to cut down the portion of each band devoted to CW and use the NEW phone bands as an incentive for extra, advanced, or other superior class licenses—perhaps with distinctive calls for each class also. I have seen this discussed in other magazines, I have heard it discussed locally and on the air. What honest and sportsmanlike reason can QST have for never mentioning it?

An important violation of honesty, sportsmanship and good taste pertains to the letters from readers printed in your magazine. Those who read only QST surely must have a vivid picture of those of us who differ with the ARRL opinion as wild-eyed fanatics tearing up membership cards, stamping on ARRL handbooks, and screaming "I hate you—I quit!". Luckily for me, I do not read only QST. The letters I read in other portions of the amateur press are quite rational, from whatever angle they approach the subject. Your selection of the letters you publish which disagree with your position is, I therefore claim, dishonest, unsportsmanlike, and in very poor taste (for instance, I know of no other magazine except the "He-man" types which will print profane or obsene letters—even with dashes inserted in the obvious places.)

A final (as of this writing) violation of sportsmanship, honesty and good taste was the first paragraph of the editorial in April QST. It is neither necessary, honest, nor fair to call the editor of a disagreeing publication names when his information differs from yours, nor is it in order to cast doubts on his competence—especially in such a top lofty and condescending manner. Wayne Green at least is an individual, quite openly stating an individual opinion (and finding room in his magazine for those who disagree with him); and QST, as the official publication of the ARRL, would do better to answer some of the questions he raises, instead of noticing him only when name-calling seems safe. Frankly, I would like to see some of the answers.

To end this on a better note, let me say that I would not for the worlds resign my ARRL membership. I value many of your services too highly.

Martha Pruitt WN4OI

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Letters

Dear Wayne:

I was at work when your "Vice-Presidency" interview came over the NBC line. Rather a surprise. "That's Our Leader," I sobbed, nervously stuffing my wig in my mouth and kicking the last QST under the console. Really a creditable performance, although you quite forgot to mention Geneva and Incentive Licensing. Congratulations, nevertheless.

Ken Cole W7IDF

Dear Wayne,

I joined the IoAR for $1.00 but I will find the other nine dollars hard to get to send you because I am on total Social Security Disability pension and you know how much you get from that. But I promise you I will send you the balance as soon as I can to help you carry on and do my share.

I enjoy your magazine very much, so keep up the good work.

Maurice E. Grenier WIGJL

Dear Wayne,

The ARRL sent me a card asking me to renew my membership. I returned it with the following note: "Gentlemen, I will not rejoin the League because of your proposal to take away my privileges on the phone bands. Go sit on a tack." I don't know if I am the only one, but I won't support an organization that I feel is working against my interests.

Carle Conway WA6TGC
Covina, California

Our recent poll showed that roughly 20% of the ARRL members feel as you do. Time enough to rejoin when they've straightened themselves out.

New Products

DX Recorder

One thing we like visitors to know right away is how many countries we've contacted. W1HOZ has come up with a brainstrom, a DX QSO Recorder. This is a heavy 8 x 10 wall certificate that explains about DX chasing and (by turning spinners) you show just how many countries you've contacted and how many have sent you QSL's. Good deal for $2.50. Viking Products, 196 S. Main, Orange, Mass.

Waters Compreamp

Bob Waters and his crew have been at it again. This time they've put a compressor and pre-amplier together and coined the word Compreamp ™ (tm means they've registered the word). This unit will not only increase the effective output of a transmitter about four times without distortion, but can also be used with public address systems and recording systems to give higher average output power. Weak sounds are amplified and strong ones are limited. Self powered. $27.95 less battery. Don't miss the Waters catalog: Waters, Wayland 73, Massachusetts.

432?

One of the simplest ways to get up to 432 these days is to put a tripler on the output of your two meter transmitter. The just announced VHF Associates tripler will handle 20 watts input and give 12 watts output. It is powered by the rf input. Price is $54.95 wired and tested, $49.95 in kit form. Write Box 22135, Denver, Colo. 80222 for info. You plug this on the end of your Gonset and away you go on 432.

Present

What do you give as a thank you when a ham does something nice for you? Or maybe puts you up on a visit. Yes, that's right, a subscription to 73. Or you could send along a pen and pencil set with his call and name on them . . . $4.50 from Viking Products, 196 S. Main, Orange, Mass.

National Linear

Mike Ferber of National made eyes pop at the SSB show in New York by demonstrating how he could drive a kilowatt wattmeter off scale with the output of this new linear. It's designed to operate with the NCX-3, naturally. Buy one right away.

Alignment Generator

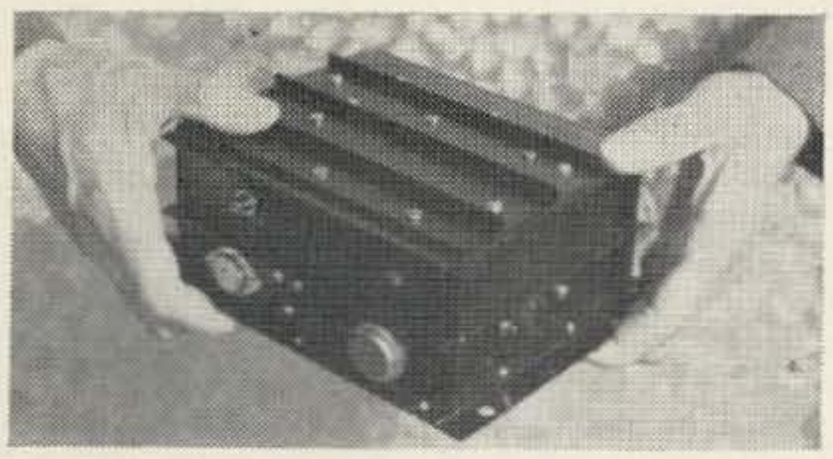
Texas Crystal came up with a fine idea. They have a little self powered three crystal

oscillator. It comes with your choice of nine *if* frequencies . . . for $29.95. For a little extra you can use any crystal from 200 kc to 3 mc. This ought to be great with 455 kc, 200 kc and 1000 kc. Write for spec sheet: 2100 Crystal Drive, Ft. Myers, Fla.

North Dakota QSL's

The North Dakota Economic Development Commission has an idea that might be of interest to other states. They've made up some mighty nice QSL cards for the Grand Forks Amateur Radio Club and now are offering them to any other interested amateurs in North Dakota. The card talks up N. D. and will be read with interest by everyone who gets one. N. D. hams should write the Commission at the State Capital, Bismarck.

Frequency Stable Power Inverter



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300-D	144-148	50-54	$12.95 ppd.
300-E	144-145	.6-1.6	$12.95 ppd.
300-F	144-146	28-30	$12.95 ppd.
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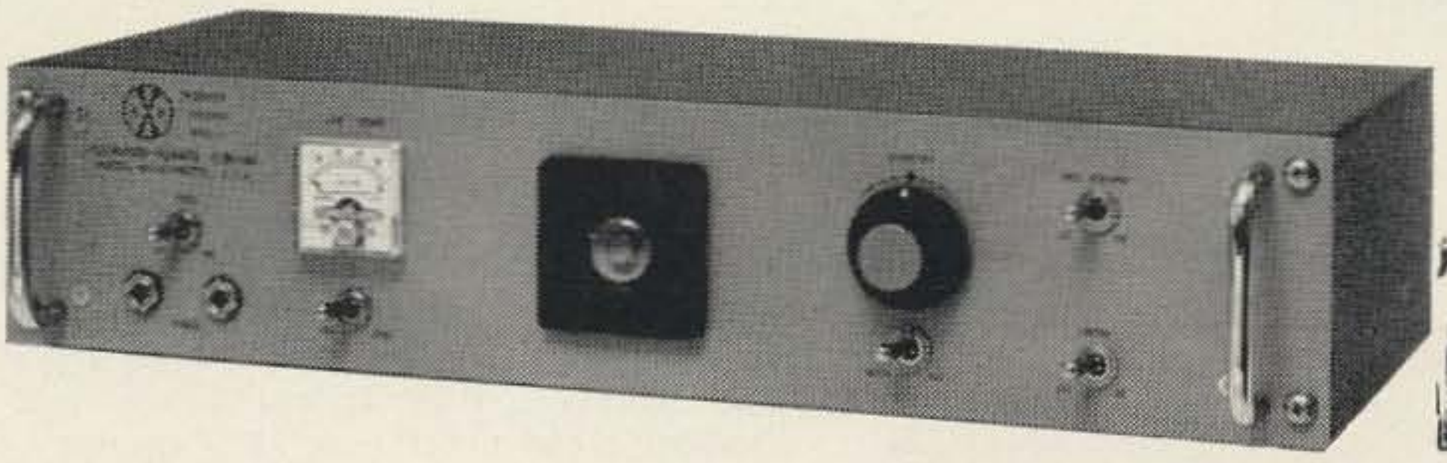

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HJS

HJC-50

REDLINE

JAFFREY, N. H.

Letters

Dear Wayne,

Nice going so far. As more time goes by, it would seem more unlikely that the FCC will take any action on RM-499. Goodness knows I wouldn't want the job of all that retesting, and the policing of it would be a nightmare.

Your idea of putting the IoAR into the business of showing other nations how a strong amateur service is in their own national interest is the best yet. It is the first idea I have seen that is likely to do a great deal of good in preserving our bands. (the same thing goes for showing our government too.)

With all of this going on it is understandable why you have not gotten involved in too many other matters what with running a magazine and all. However, there is one item which might do a lot of good if it hit the pages of 73 before the next meeting of the ARRL's Board of Directors. This is the matter of By-Law 8.

You already have a copy of the letter which I wrote to all the Directors on the subject, so I won't go through all that again. It is easy enough to show that it is illegal under the League's own Articles of Association, etc.

One thing which I would like to point out is that By-Law 8 has a definite relationship to the RM-499 mess. The line of reasoning goes like this: By-Law 8 is an outgrowth of the League's opinion of the Conditional and Technician class license holders. It considers them to be lower of life—unfit to hold office in the League. Now RM-499 wants to make the General Class a lower form of life. How long would we be considered fit to hold office if RM-499 were to pass? Remember, the Generals would have far fewer operating privileges than the present Conditionals.

Consider too that a large percentage of the nation's amateurs are Conditionals and that they are found in areas away from heavy population centers. This means that those elected to be Directors tend to come from the denser population areas. This may not be good. It is certainly unfair to a General such as myself who knows and respects several Conditionals and would like to nominate one of them for director.

I could run this on and on, Wayne, but I'll cut it off here. I just wanted to remind you of this. I hope that you will see fit to give it a push in the right direction.

James S. Hunt K5ZXL

Dear Wayne,

Thank you for your reply to my letter of inquiry concerning the purpose of your opinion poll. I must explain, however, that I had never read any of your editorials. I had never seen **73 Magazine** but was asked to vote by ARRL supporters. In brief, I have been sheltered in the pages of **QST** and was quite unaware of the existence of I O A R .

Your taknig the time to answer my letter as you did was so appreciated that I sought out and borrowed the past six issues of 73 and digested the contents of your editorials and other pertinent articles. I think you have

real genius in the editorial field. You're a prolific idea generator and you have the power of expression to communciate them effectively. I would be pleased to be acquainted with you.

I shall get to know you better as I read your editorials in the future, for I am enclosing my check for a year's subscription to **73 magazine.**

This is not to say that I agree with all of your ideas on the incentive licensing issue, but you certainly have enlarged my field of vision on the subject. On the critical side, I feel that you occasionally become carried away with the spirit of opposition and have a tendency to be a little too vindictive. I also note that you occasionally depart from your usual factual logic and resort to innuendo or defend something which is not entirely consistent with your previous line of thinking. The risk here is the suggestion to your readers that your editorial genius may be subordinating to mercenary considerations. I sincerely hope that this is not or will not be true either consciously or subconsciously even though it is clearly evident that you could stand to profit handsomely from the major split in the amateur ranks.

I think your criticisms directed toward the League are a good thing. I have felt that a number of reforms were in order for a long time but was unaware of many of its shortcomings which your magazine has pointed out, and which information I was not likely to obtain from QST. In your criticisms of ARRL, however, I ask that you try to be charitable and constructive at all times and consider that a careless innuendo or the mention of an unfounded rumor, other than to discredit it, may sow seeds of hatred among the ranks. I know from your editorials that you do not seek to destroy the League but to institute reforms, but again I caution that hastily phrased thoughts put in print may be destructive.

It is quite likely that the F.C.C. will reject RM 499 and the foes of ARRL will rejoice in its defeat, overlooking the actual service which it performed by forcing the issue. All of the editorials that the ham magazines could ever publish could not have awakened the ham population from their complacency like that single controversial act of submitting RM 499! You tell me that you have been fighting the status quo for twelve years but what have you accomplished that can compare to the awakening produced by RM 499? So maybe you shouldn't be too hard on the League officers for this because it may be just what we needed—a good luck!

On one hand, I think that the ARRL needs a man like you in its administration, but on the other hand, I'm glad you're outside because it needs a good critic even more, so more power to you. But please, for the sake of T.O.M., be charitable—remember they're amateurs, hi.

Since the back issues of **73** that I now have are borrowed, I wonder if I might be able to purchase from you the last six issues (Oct. '63 thru Mar. '64)? And don't forget to enter my subscription promptly——I wouldn't miss your editorials for the world from now on.

Paul R. Noye K2KAM
Tonawanda, N. Y.

Back issues are on hand (50c each). Is it OK if I am charitable to the amateurs and hard on the professionals? You're right about 499 . . . three cheers. I try to be constructive, but a times my patience is too sorely tried . . . I'm fallible. Regarding unfounded rumors, please remember that these basic tools for any writer who wants to influence events without suffering law suits.

Dearborn, Michigan

There'll be an Old Timers Night at the Henry Ford Museum on May 30th put on by the Motor City Radio Club. W4FZ will be the main speaker of the evening. Special certificates are available to anyone working W8MRM starting on the 29th. They'll be on all bands.

HEY! WIRE!

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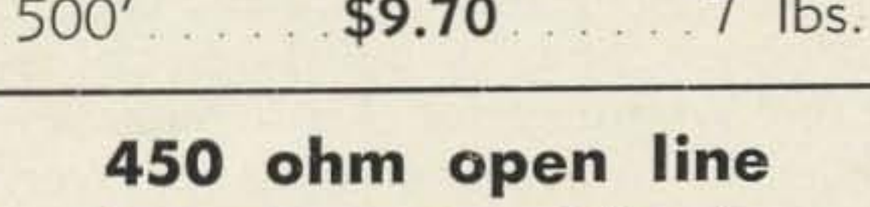

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REDLINE

JAFFREY, N. H.

Vladimir Gercke K6BIJ
Box 143
Weimar, Cal.

TVI

The Handbook and most of the magazine articles on TVI seem to advocate a shielding principle of TVI suppression, in other words—let TVI run wild inside the transmitter enclosure, but do not let it out. This is accomplished by an airtight transmitter cabinet, feedthrough condensers, shielded and bypassed cables, rf chokes, cans over meters, and finally a low-pass filter to let the fundamental out.

The following experimental circuit approaches the problem from another side—it does not *generate* any TVI, so that you have nothing to suppress, and therefore you will not need any of the above precautions.

Let us take a very popular grounded grid kw final with a pi-network output (Fig. 1).

The tube elements, Lp, C1 and the leads between them, form a tuned circuit resonant close to TV frequencies. This circuit can either amplify TVI or produce it. Lp—is a very mysterious component, every final has one; its size, diameter, and the number of turns (as well as explanations as to its purpose)—varies with the weather, author's diet and position of the planets. Generally it has about 5 turns ¼" i.d. and is supposed to do something. People that like the smell of burning carbon resistors put about 100 ohms across it.

A much larger coil in place of Lp will make either oscillations or amplification at TV frequencies impossible because the tube plate will be isolated by this coil (acting like an rf choke) from its VHF tank. A still larger coil will make it impossible to amplify the fundamental, as it will isolate the tube from its fundamental tank.

Now, if we make Lp about double the size of L2, we will find that the circuit still works at the fundamental, but any generation or amplification of TVI frequencies is no longer possible.

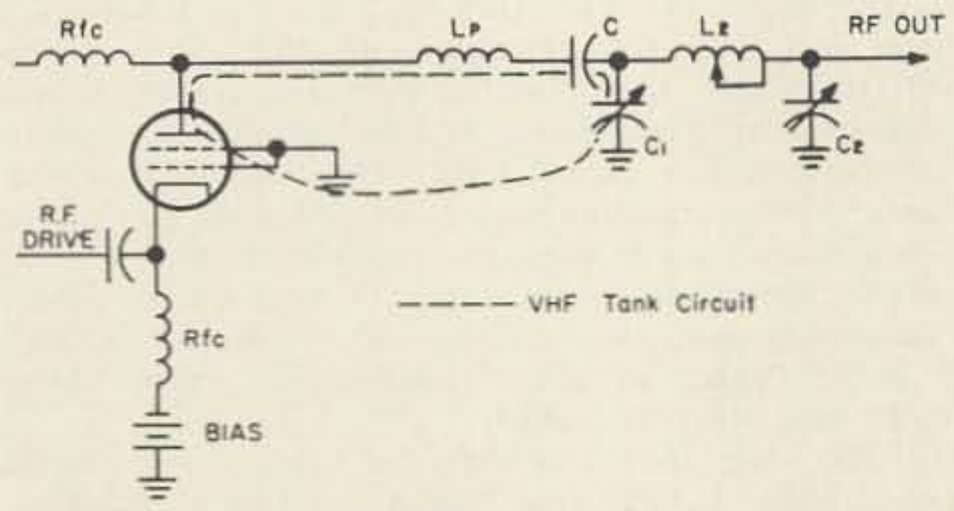

FIGURE 1

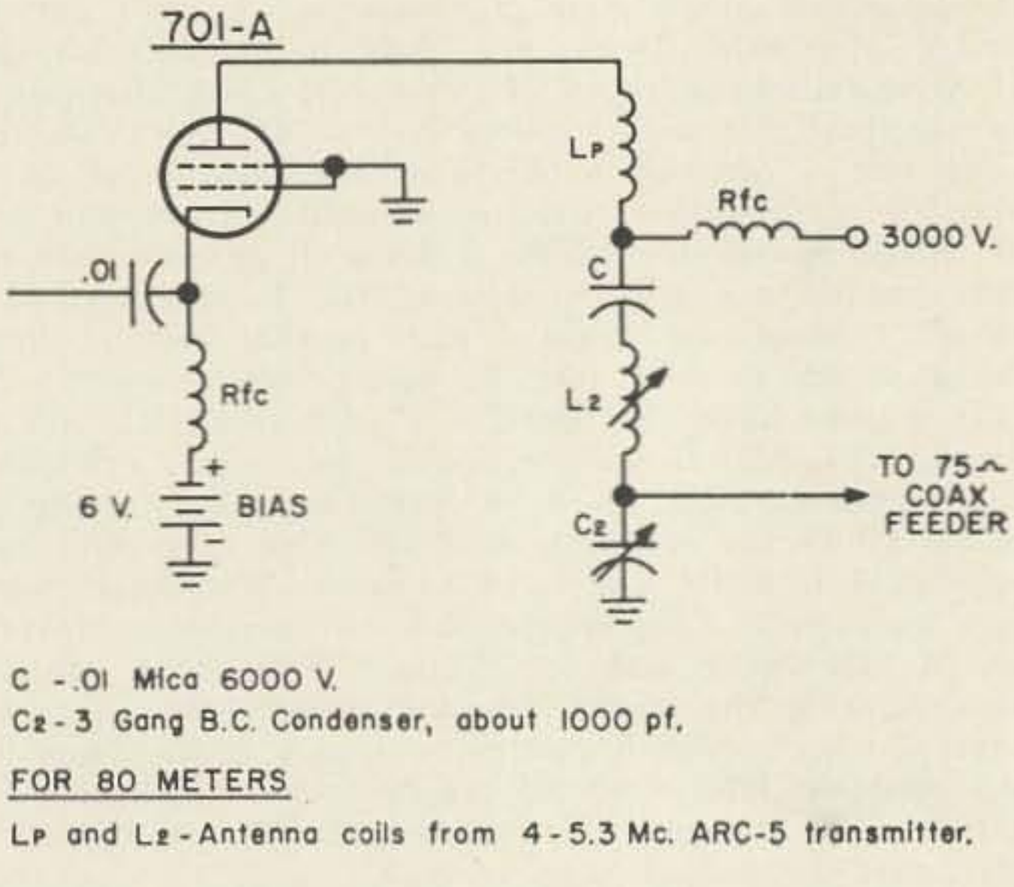

FIGURE 2

Further examination of the circuit shows that C1 is not necessary, and RFC can be moved to the cold end of Lp (to remove most of the rf voltage from it). This way we arrive at the circuit Fig. 2.

Any radio engineer will tell you that this circuit cannot possibly work, but the circuit does not know it, and is pushing rf into the antenna as a grounded grid linear with normal efficiency and not a trace of TVI, while the engineers stay off the air when their wives are watching television.

The circuit in Fig. 2 is strictly experimental (it is a form of a series resonant tank); it was used on 80 and 40 with a single 701-A or a

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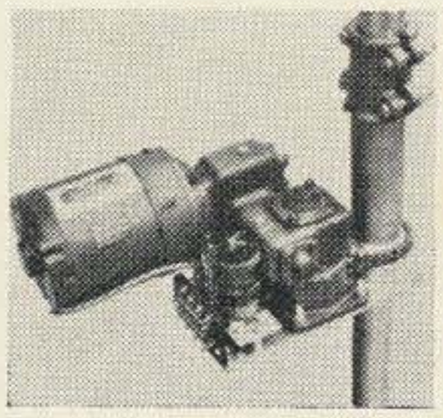

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Page 42 September QST and Page 60 October QST

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Novice Transmitter

Robert Stessel K1WXY
130 Columbia Street
Peace Dale, Rhode Island

In my town of modest ham population, I have seen several mobile phone transmitters sitting, just gathering dust. There are probably quite a few more around the country. These transmitters, usually xtal controlled and with inputs under 75 watts would make dandy first transmitters for Novices if they were converted to fixed, CW operation.

Three things must be done to mobile transmitters to make them suitable for Novice use. (1) Provide for CW operation; (2) provide B and filament power; and (3) provide for antenna changeover from receive to transmit.

To convert the transmitter to CW, find a convenient spot on the chassis for an open circuit key jack and mount it. Then break the connection from the final amplifier to ground and then connect the cathode to the jack and bypass the cathode to ground with a .001uf 1000 volt disc capacitor. (See Fig. 1) Next mount a 3Pdt switch on the chassis (on the front panel if there is room) and connect it as in Fig. 2. The switch shorts the key jack in the AM position so that the transmitter may be used when the General ticket arrives. On CW, it turns off the B to the modulator and shorts the modulation transformer to prevent unwanted keying transients.

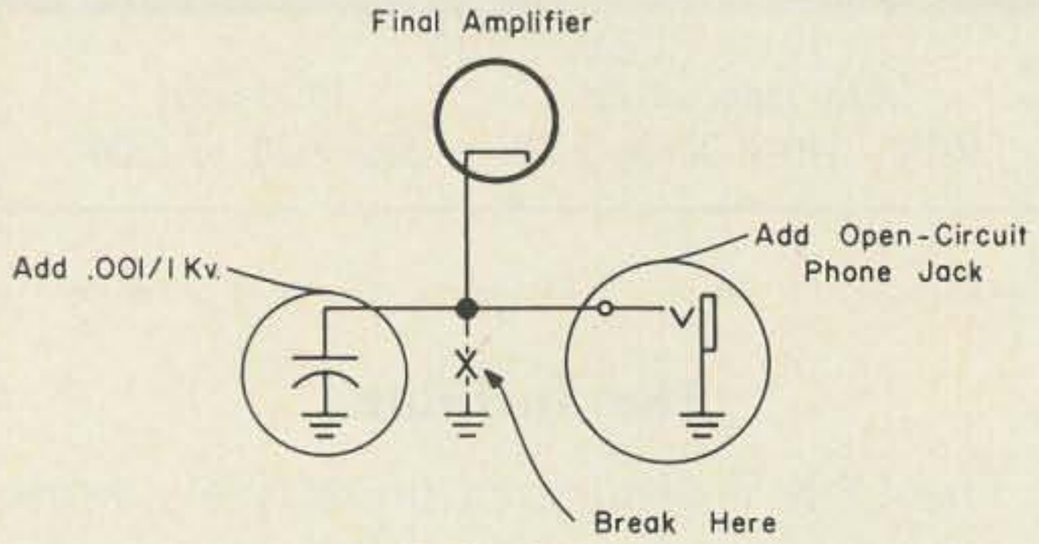

FIGURE 1

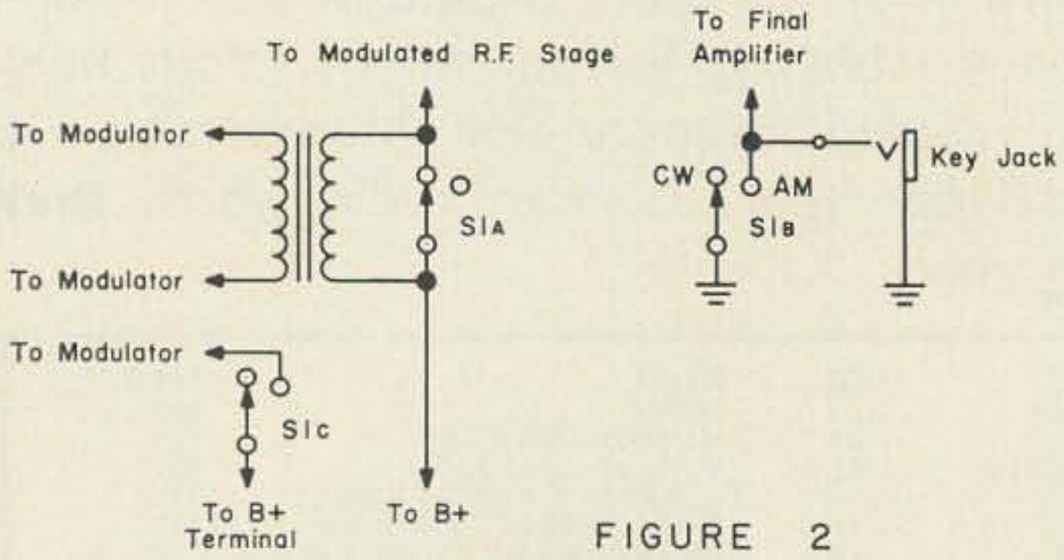

FIGURE 2

A schematic for a power supply is shown in Fig. 3. The power transformer should have a high voltage secondary voltage of twice the dc output voltage required. The filter choke and the transformer secondary should be rated at about 150% of the total dc current drain. The filter capacitors should be rated at 150% of the dc output voltage. If the transmitter requires 12 volts on the filaments instead of 6 volts, a 6 volt filament transformer will have to be connected in series with the 6 volt winding on the plate transformer. (See Fig. 4).

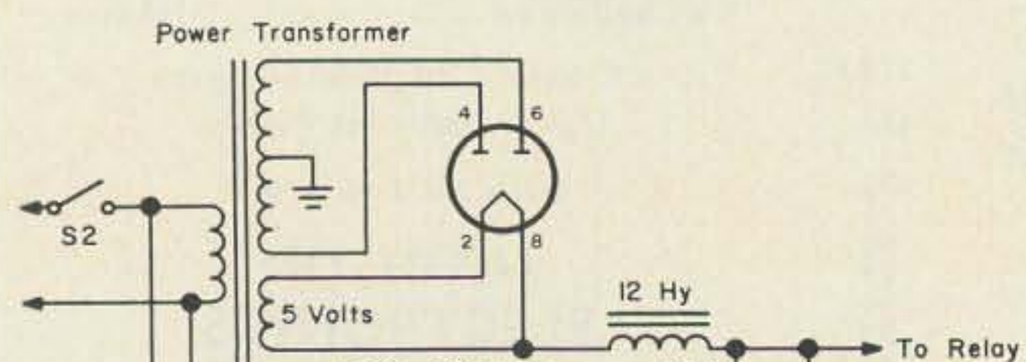

FIGURE 3

To operate the changeover relay, a power supply delivering low voltage dc could be built, but this experiment failed miserably at KN1WXY. Adhering to the old phrase: "If at first you don't succeed, to heck with it!" I replaced the dc relay with one that operated on 110 volts ac and wired it as in Fig. 5. If you want to keep the dc relay for possible mobile work in the future, mont the ac relay inside a small minibox and bolt the box to the transmitter somewhere near the rf output cirquitry. Then mount a feed-through insulator on the box so that one end of it is in the mini-box and one end in the transmitter and wire it in. The terminals on the relay marked receiver can be used to short the speaker in transmit using the normally open terminals or to open the receiver power transformer secondary during transmit by using the nomally closed terminals. If full break-in operation is desired, connect the

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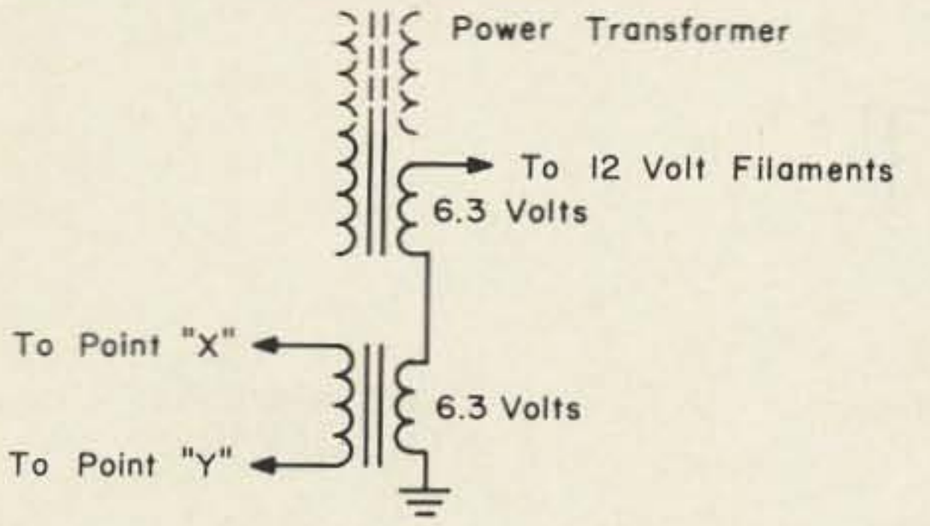
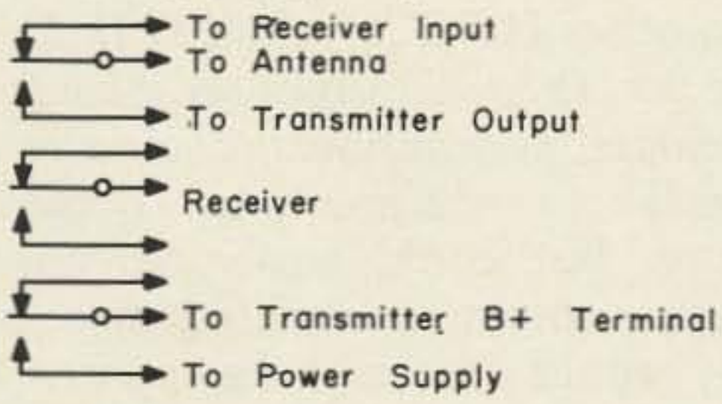


FIGURE 4



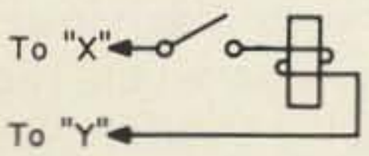


FIGURE 5

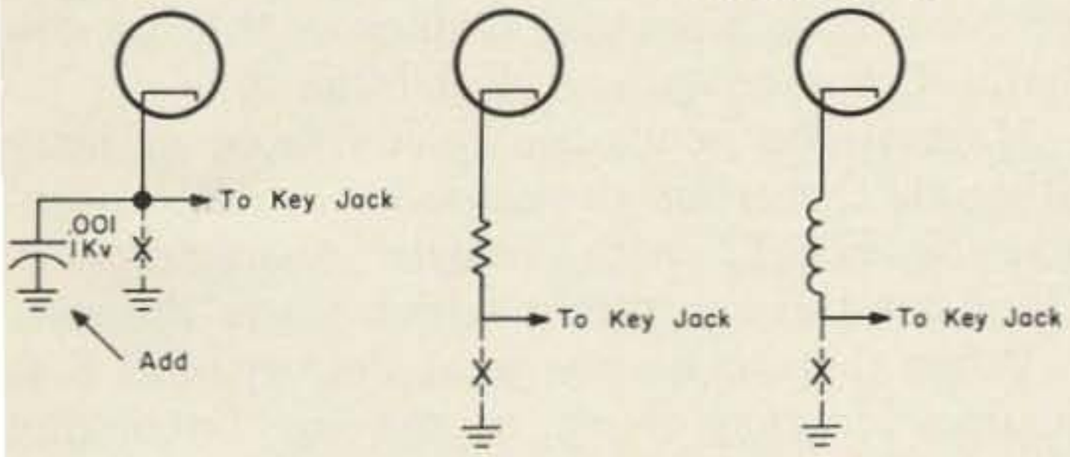


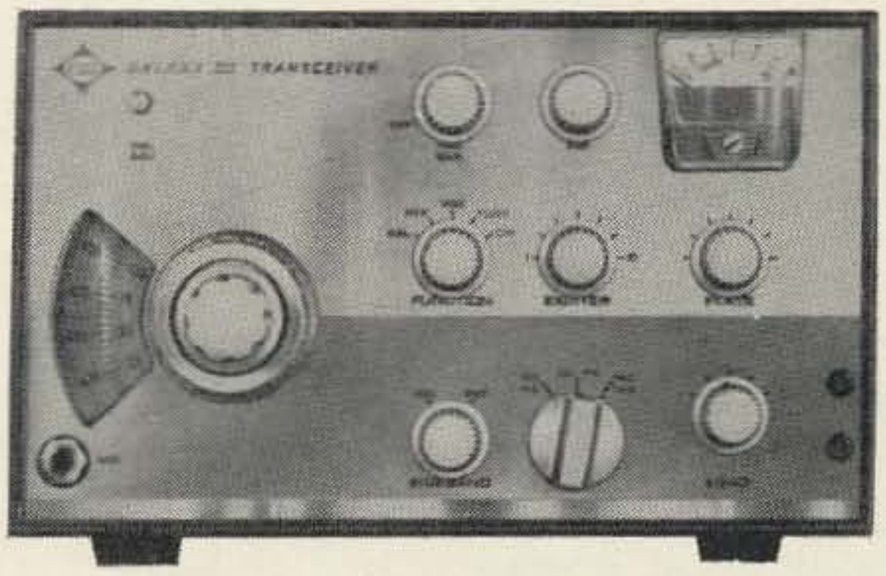
FIGURE 6

athodes of the oscillator and any driver or nultiplier tubes to the keying jack and discon- ect its connection to ground. If the cathode is t rf ground, bypass it as in the final; if it is bove rf ground (if it has an rf choke between and ground) connect it to the keying jack t the point at which it is grounded and break s connection to ground (See Fig. 6). Discon- ect the receiver from the relay and leave the ransmit-receive switch in transmit all the time. With break-in, a separate receiving antenna ust be used, preferably at an angle to the ransmitting antenna. If this is inconvenient, an lectronic TR switch could be used. A good cir- uit was shown in the May '63 issue of 73.

This completes the modifications. Because of ne wide variety of mobile transmitters floating round, no operating instructions will be given ere. Tuning-up will be the same as with AM, o ask the previous owner how to tune your new Novice transmitter.

Much thanks to W1BXZ, K1IDX, and W1QLT for the help in getting me started in hamming and homebrewing. . . . K1WXY

NOW!



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DENVER, COLORADO 80222

(An anthrozological study based on five years of research by the author, who carried out her investigations at gatherings of the genus throughout Britain and Europe, particularly at the Radio Communications Exhibit in London.)

H. S. T.

Sylvia Margolis
XYL-G3NMR

HOMO SAPIENS TRANSMITTENS is a warm-blooded vertebrate, despite several indications that both these initial premises are without foundation. It is a specialized mutation of HOMO SAPIENS NORMALS, developed within the first half of the twentieth century, and likely to continue evolving into the Space Age, unless more and more emerging nations are going to demand frequencies for broadcasting their national propaganda, in which case the genus might become extinct *—viz. "Dinosaurs I Have Known" (Fred Flintstone)* and *"Dodo Where Art Thou?" (Terry Dactil.)*

While HOMO SAPIENS NORMALS and HOMO SAPIENS TRANSMITTEN evolved originally from the same species, the two geni are rapidly drawing apart. There is now little resemblance between them and some authorities admit to their inability to recognize any of the behaviour patterns of H.S.N. in the more highly modified specimens of H.S.T. In any ritual gathering of H.S.N., a well-developed H.S.T. will stand out like a *thumbus sorus*, distinguished by his appearance of wishing he could get the hell out of here.

Distribution—The genus is to be found in every Continent, but with the greatest density in areas with high living standards. It is a boast of the genus that it knows no barriers of race, belief or background. In this respect we recommend students to refer to "*Hamlet,*" Act 3, Scene 1, lines 8 and 9 of the "To be or not to be" speech.

It is interesting to note that H.S.T. develops the transmittens faculty superimposed onto his national or ethnic characteristics, but that the transmittens faculty eventually over-rides the normal behaviour patterns, producing a truly international H.S.T. who hardly differs from other H.S.T.'s, whether he be from Singapore or Oslo, Durban or Montreal. He has developed a complicated classification system himself to differentiate between national groups, but could easily carry on the transmittens operation without this, whereon nobody could be any the wiser. It is almost impossible to distinguish between the various nationalities on the tribal occasions when they all congregate, such as I.A.R.U. Conferences, the New York Sideband Dinner or the London Radio Communications Exhibition.

Most of the genus are male (more or less) although there has developed a small proportion of H.S.T. with female characteristics. These are the exceptions which prove the rule.

When there is a very great density of H.S.T. in one location there occurs an interesting phenomenon known as "QRM" (*Quod res miserabilia.*) This causes great distress to all specimens who then devote great energy trying to persuade each other to move house or to try 70 cm. working.

Habitat—A noticeable disregard for the basic comforts and for the condition of the habitat is a distinguishing feature of H.S.T. The living room may need decorating, the closet door hanging from one screw, the plumbing may be making sinister noises and showing alarming symptoms, whilst there may be wiggly cracks in the foundations. However, H.S.T. is more closely concerned with the state of the beam and with protecting his V.F.O. from damp. Those few H.S.T.'s who live long enough, and who have enough dough, to build the ideal house for retirement, employ weak-willed architects who agree to design, first a central tower, then arrange round it grudgingly a few inessential items, like kitchen, bathroom, bedroom.

H.S.T. thrives in an atmosphere of litter, scattering components and instruments round the habitat and dropping blobs of solder on the rugs. He tends to decorate the habitat with objects known as "QSL's" (*quod sillius laborowastus.*)

There is a noticeable trend to living on high ground, where the height is advantageous to the transmittens faculty. He will also seek isolated habitats, because of a condition which renders him very offensive to H.S.N. This is known as *te livis ion inter ference*. Extreme cases of this condition have been known to cause physical struggles between the two geni and there have been occasions where H.S.N., normally a peaceable creature, has banded together with his fellows and destroyed the transmittens faculty of an offending H.S.T. This is a lamentable situation.

Language—As the genus rarely speaks socially, except to another of the genus, language differences present few difficulties. A signal crystal frequency synthesizer or a fundamental flip-flop circuit are much the same, whether in English, Serbo-Croat or Urdu. One of the most striking features of the langauage of H.S.T. is *how much of it there is.* This is demonstrated every night on twenty metres sideband. H.S.T. can take longer to say goodnight than any boy on his girl's porch.

When H.S.T. first began to evolve from H.S.N. he did so in the form of a primitive creature known as a "CW Type." The CW Type was unable, because of technical difficulties, to converse in conventional language, so used a system of long and short squeaks (*lingua samuelis morsi.*) During the past thirty years this form of communication has been superseded by something more resembling normal language, although large numbers of the genus prefer to use CW and insist that it is a form of communication superior to ordinary speech. It is interesting to note that present-day H.S.T. still reverts to this atavistic practice and his language bears witness to the old forms. He will, for example, call his wife "his XYL," painstakingly explaining that this means "ex-young-lady," despite her protests that she is neither ex-young nor ex-lady. A primitive way of expressing mirth, similar to the *rictus* of *Pithecoidea*, is "Hi."

Anatomy—To the greater extent the creature resembles H.S.N. physically. There have, however, developed specialized physical features, such as the mike-bend, carrier-eliminating larynx, built-in wife-and-child-filters and exceptionally modified Eustachian tubes, in the case of HOMO SAPIENS S.S.B. TRANSMITTENS, which are only capable of reading

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Physiology—H.S.T. possesses, as far as can be ascertained, the same basic functioning patterns as H. S. N., although, again, some of these have undergone considerable modification during the evolutionary period in order to fulfill efficiently the transmittens function. H. S. T. is capable of immense feats of physical endurance, whereby he can stay awake for fully forty-eight hours, during the Sideband Contest or National Field Day, whereas fatigue overtakes him the moment he has to associate with H.S.N.

Food—It is customary for the genus to leave its food for long periods after serving before eating it. Thus he shows a preference for cold, congealed, toughtened, soggy and altogeather revolting food. In this respect the genus can be compared with *crocodilus porousus*, which keeps its kill in secret hidey-holes under the water, not eating it until it is partially decomposd.

Drink—H.S.T. does a lot of this. Indeed his marked predelication for beer could well be the basis of serious experiments to see whether the genus could be entirely nourished on a diet of alcohol. There is even a belief that large quantities of alcohol improve the signal. Experiments in this field are enthusiastically carried out any New Year's Eve on seventy-five meters.

Reproduction—It is possibly in this field that H.S.T. differs most markedly from H.S.N. There is a remarkable tendency to ignore, or at least to hold in the deepest suspicion, females. This accounts perhaps for the extremely high percentage of bachelor H.S.T.'s. Of the small proportion of female H. S. T.'s encountered during my investigations, I would only quote the old saying about the female of the species.

It is on close examination something of a miracle that H.S.T. manages to reproduce itself at all, considering that at the crucial moment, he is likely to remember how precisely to couple the output from the plate circuit of the harmonic amplifier into the receiver. The usual taradiddle attached to the relations between the sexes in H.S.N. is given scant emphasis in the courtship procedures of H.S.T., to whom the whole darn thing is of no interest whatever.

Thus H.S.T. ignores the conventional stress on phallic symbols of modern H.S.N.—sharp dress, snazzy automobile etc. Instead he sublimates his biological urges by competing in CONTESTS. With Contest goes certificate hunting. To enlarge on this theory, we suggest

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that the serious student of anthropology watch a barnyard rooster putting on the style in front of another rooster. Then the student should give the same attention to H.S.T. displaying his collection of diplomas and rare QSL's to another H.S.T. who has a shorter antenna. Some experts put forward the theory that the interest shown in the reproductive conventions is in inverse proportion to H.S.T.'s DX score.

To give a convincing example, whereas H.S.N. would entice a girl up to his apartment to show her his Japanese prints, H.S.T. will invite her to examine his linear and exciter. And show her his linear and exciter is exactly what H.S.T. will do.

Evolution—That H.S.T. will evolve and alter his functioning continually is a surety. Already one sub-genus of the genus has become almost obsolete—the "A.M." operator. Isolated pockets of these specimens still exist but they are rapidly dying out. An important sub-genus—the "VHF Type"—is developing on its own lines and may at some time present another genus as different from the specimens of H.S.T. discussed here as H.S.T. differs from H.S.N.

Conclusions—The study of HOMO SAPIENS TRANSMITTENS presents a most rewarding field for the serious student. The author has attempted here to give only a basic survey but would welcome enquires, data and further information from any readers who are interested in investigating this most intriguing of Nature's mistakes.

Hobbyist?
Write about it

Gordon Hopper W1MEG

Industries related to electronics, aviation, chemistry, automotive, and photography are often found to contain a nucleus of people who carry their technical abilities into various hobby fields. Included as part of this nucleus are various publications people such as writers, illustrators, parts listers, etc. It is to these technical writer/hobbyists that this article is directed with the intention of encouraging writers to write more technical articles for the hobby type of publication.

My own personal interest in the hobby

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field applies to amateur radio. There is a noticeable shortage of articles available today relative to the subjects of parametric amplifiers, pulse transmissions and techniques, laser and maser design, construction, and their advantageous uses, plus some of the more advanced forms of communications such as teletype, television, multiplex systems, and facsimile. In addition, commercial manufacturers offer opportunities for a writer to conduct tests on various types of equipment to result in a written report of its capabilities, qualities, features, specs, operation, etc. to be published in the hobby magazine.

In the numerous technical publications that are on the market today, there is always a need for better written technical articles. Currently, these articles are generally written by people not engaged in the writing profession and, consequently, this puts a heavy workload on a magazine editor if he deems the article worth buying.

Technical writers already having qualifications such as writing to government specifications, a technical background, the ability to read and interpret complicated schematic and mechanical diagrams and drawings, plus the competence of incorporating engineering data into technical manuals and various publications, are ideally suited to write technical magazine articles in their spare time.

If these writer/hobbyists were to write technical articles for magazines on a level commensurate with its readers, the quality of the articles could be noticeably improved, thus raising the standards of the publication itself. Magazine editors are busy people and most of them will accept articles that are well written and which require little or no editing much more readily than they will accept an article which needs changing, correcting, or rewriting. Most magazine articles are written to a general set of rules (format, illustrations, length, etc). Magazine editors will furnish you, upon request, with their specifications and rates of payment for accepted work.

Let me recommend that you investigate the technical hobby magazine writing field and then submit articles to these magazine editors. Hopefully, the quality and standards of these magazines would be raised, readers' knowledge would be increased, you would be paid for your work, and you would achieve some measure of prestige. Incidentally, there is no better way of stirring up interest in your pet theory and of meeting people with similar interests.

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. . . WIMEC

(W2NSD from page 4)

who went on record were opposed to 499. Strange that this figure should be the same as the result of our ballot, eh? They found that the single petition that had the greatest support was the one filed by W4RLS, Foy Guin. Fifteen amateurs went to the trouble to submit petitions . . . and only one was in favor of the ARRL . . . the one by Bill Orr W6SAI. 14 to 1 against the ARRL . . . hmmm. The directors might want to question Mr. Hoover about that.

They might also ask him what he thinks might happen if the FCC were to pass 499 into law and another earthquake were to hit Alaska. Out of some 800 amateurs up there who can use 20 meters, only 150 are Advanced Class. Communications were difficult enough during the recent difficulty with the few Alaskan ham stations . . . imagine if only one fifth of them had been able to use twenty meters! As I pointed out in previous editorials, we have few enough amateur stations right now when it comes to providing emergency communications.

Institute of Amateur Radio

The first board of directors meeting of the Institute was held in New York on March 23rd with four of the seven interim directors present. Present were Bill Ashby K2TKN, Wells Chapin W2DUD, Lloyd Haslam W3AYA, Harry Longerich W2GQY/4, plus Virginia and me. Absent were Bill Leonard W2SKE, Edwin Schaad WA4PDX, Maurice Hinden W6EUV.

(Turn to page 86)

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Correction

April 1964 issue

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A financial report was made. The membership dues for 1963 had been more than offset by the loss on the Institute tour, leaving the slate fresh for 1964. As of March 21st we had 328 Founding Members ($10) for $3280 income. Expenses for certificates, membership cards, newsletter and clipping service had been $265, leaving a net cash on hand of $3015.

The Newsletter was reported to be almost ready to begin publication. Special paper had been selected and purchased for it, a newspaper clipping service had been engaged and more than enough information was coming in to publish a newsletter weekly on the public service aspects of amateur radio. The mailing list of Congressmen and government officials was being made up.

The Directors agreed to relieve me of the responsibility for actually guiding the Institute, though I promised that I would do everything that I could to carry out their decisions and to help the Institute grow. I offered to make at least two pages a month in 73 available for the dissemination of news of the Institute at no charge for at least five years.

A discussion of the need for a constitution and by-laws brought complete agreement that this was one of the most important immediate tasks for the directors. Considerable help is expected for their formulation by the two directors who are also lawyers. The result of the directors thinking will be sent to the members for their comments.

There was general agreement among the directors that we should expect a strong attack by the ARRL through the pages of QST, through CQ, at conventions, and just about everywhere else. The growth of the Institute can be expected to be as popular with the ARRL as the growth of a reform movement is to an intrenched political machine.

The Directors

Undoubtedly you know some of the directors of the Institute. I'll try to have short biographies and a picture for you by next month. I'm very proud of the fellows who have agreed to help get the Institute started on the right foot. You must know Bill Leonard W2SKE of the Voice of America ham program, of CBS TV, inveterate contester, and hamfest toastmaster. Wells Chapin W2DUD should be familiar to you if for no other reason than his recent articles in 73. He has a marvelous background. Ed Schaad WA4PDX was Chief of Army MARS 1958-60 and retired as Lt. Col. in 1962. Harry Longerich W2GQY/4, also recently retired from the Army, was Commanding Officer of the European Intelligence Division. Maurice Hinden W6EUV is a very well known West Coast attorney who has helped many hams out of ham legal difficulties. I ran an interesting series by Maurice in CQ a few years back. You all must be familiar with Bill Ashby K2TKN (ex W9ETJ) . . . he has the feature article this month . . . a break-through development.

I don't know if there is any way to make sure that we continue to have directors of exceptional intelligence and dedication; I sure hope we find a way.

To ARRL Directors

In a few days you will all be getting together for one of your yearly Board meetings. Fellows, we are all going to be watching the fine print in QST very carefully to see how seriously you take your jobs.

We'll be watching for yes-men and unanimous decisions.

I'll be listening for reports to see if you let those rascals get you together for a secret meeting before the regular meeting to cook up schemes which won't appear in the official minutes. Don't try any of that "committee of the whole" on us either, we want to know what you are doing for a change.

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If you get a sort of helpless feeling and find that you're being voted down at every turn, don't worry about it. Even if you find that you don't somehow seem to have the power to run the League that you and the State of Connecticut thought you had, you can relax a bit for you know that there is always going to be the Insitute of Amateur Radio to pull your fat out of the fire. The Insitute has already started a regular mailing of an information newsletter to nearly one thousand congressmen and government officials with the object of making better known the public service of amateur radio and its benefits to our country. The Institute has an official representative in Washington and is planning on having its headquarters there. So don't fret if there is more money and attention being lavished on the ARRL big yearly free booze party at the Parts Show in Chicago than on lobbying for our hobby.

Don't get frustrated when you try to find out what good the IARU is going to do for us. Don't let vague platitudes upset you when you ask what is being done to approach the people who will be gathering at Geneva next year (in 1965) for the plenipotentiary ITU conference in order to get ham radio a better shake. Oh, look up "plenipotentiary" in your dictionary and bring the definition to Hunty . . . a recent panic mailing by him (published in CQ) gave evidence that he either doesn't

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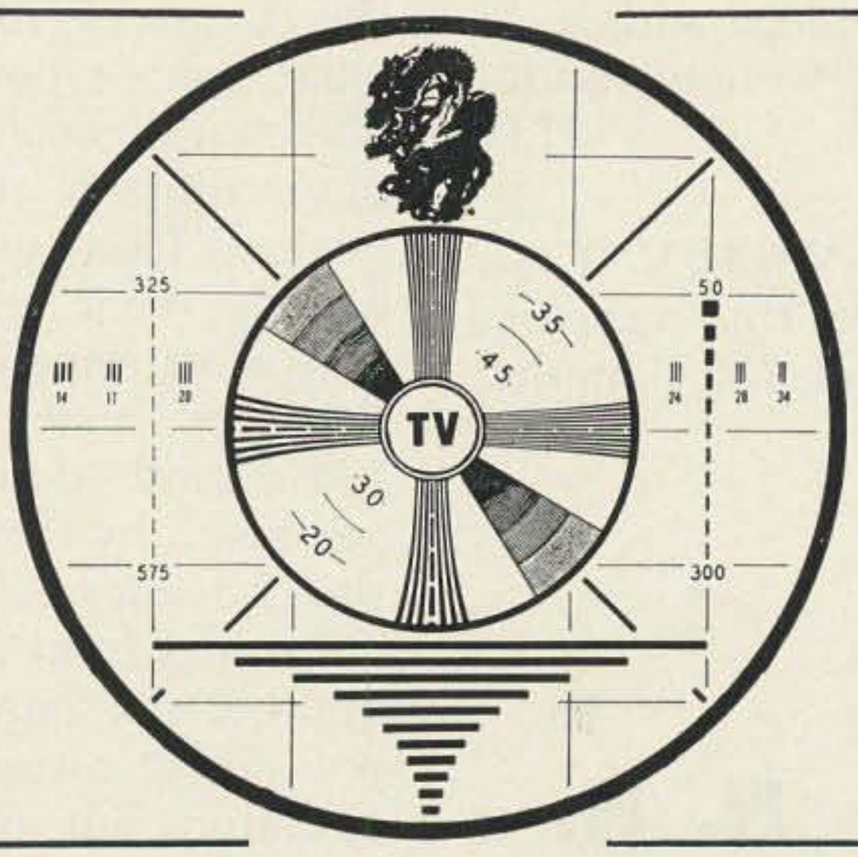

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73 Inc

Peterborough, N. H.

know what it means or was trying to pull wool over eyes, or (I suspect) both.

Remember, as more ARRL members get fed up with words instead of action, that the Institute is going to be able to tackle the international situation on a more direct basis . . . sending out an international edition of the information newsletter . . . getting travelling amateurs to visit foreign officials and answer questions they may have . . . getting amateurs who are visiting foreign countries to set up locals with a club station provided by the Institute (a program we've already started) . . . etc.

Incentive Licensing

Some time ago, while looking over all of the petitions which had been filed with the FCC on the subject of incentive licensing, I became aware that none of them included all of the ideas which I had put forward in my editorials. In looking over the list of the factors of RM-499, I could see that my overall plan seemed to provide all of the good points of 499 without any of the drawbacks. It even had some additional benefits and solved some problems which 499 left begging.

My major objections to RM-499 are these: 1) since 499 will remove over 75% of the presently licensed amateurs from the major phone bands unless they pass a new exam and since we know that not all 100% of those affected will get the new license, we must admit that 499 will reduce the occupancy of our most important international phone bands. This, unfortunately, will happen at the worst time possible, just before a Geneva conference. 2) 499 offers no incentive for the CW operator. Is there some reason why a CW operator needs no encouragement to improve himself technically? This is plainly discriminatory. 3) 499's message to either get a new license of else get off the major phone bands is not incentive, it's compulsion. Many agree that compulsion is the enemy of freedom. 4) 499, as described by QST, cannot possibly achieve even the vague objectives mentioned by ARRL. A slightly more difficult test than the present one for General Class would only mean more memorization. What on earth does this gain us? 5) 499 is extremely unfair to the General Class licensees since they have already passed a test almost identical to the one passed many years ago by the Advanced Class operators. Yet the Advanced Class have mysteriously been exempted from re-examination. 6) 499 directly opposes not only the FCC's stated policies of not taking away privileges from any licensed operator, but opposes the established demo-

cratic system of the U. S. wherein privileges, once earned, are not summarily taken away.

There is no real reason why our proposed legislation has to have all of these serious drawbacks. It is quite possible to work out a plan which will achieve the stated goals, avoid the above difficulties and solve several long standing problems to boot.

What would we like a proposal to accomplish? Well, we want it to provide incentive to fellows to improve their technical knowledge. It should provide incentive for both phone and CW operators. It should not force anyone off any of the bands they are using at present or diminish the value of his equipment by rendering it useless to him. It should do something for the Extra Class license to give it some meaning. It should not impose any severe hardships on the FCC from the standpoint of divising license exams, adminstering license exams, or monitoring our bands. It might even do something about the almost completely unused lower 100 kc portion of six meters which the ARRL rammed through against all reason a few years back. It might recognize the advancement of sideband by establishing some SSB bands. It might also recognize the growing percentage of amateurs using phone by expanding our phone bands somewhat.

Proposed

I propose that two new classes of license be established; and Extra Phone and Extra CW. Holders of the present Amateur Extra Class license would automatically be issued both of these new licenses. Holders of Advanced, General and Conditional Class licenses could qualify for either or both of the new licenses after a minimum waiting period of one year in the present class of license by passing an FCC supervised license exam.

The Extra Phone license would be available to those passing the theory test given for the First Class Phone (commercial) license (let's see anyone memorize their way through *this* one) or those having in the past passed this exam. The Extra Phone licensees would have all operating privileges of all lower class licenses plus the use of suppressed carrier telephone in the following bands: 3750-3800 kc, 14150-14200 kc, 21.20-21.25 mc, 28.4-28.5 mc, 50.01-50.10 mc. (The Novices lose a little on 15 meters and note the sideband on six meters).

The Extra CW license would be available to those passing the theory and code test given for the First Class Telegraph (commercial) license, or having in the past passed this test.

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K6JCN $6.50

CW MONITOR. Connects right across your key and gives you a tone for monitoring your bug. Page 44, June '63.
WA2WFW $4.25

73 Inc.

Peterborough, N. H.

Extra CW licensees would have all of the privileges of the lower classes of license plus the exclusive use of the following CW bands: 3500-3520 kc, 7000-7020 kc, 14000-14020 kc, 21000-21020 kc, 28000-28020 kc.

To permit quick identification of Extra Class licensees a distinctive call should be issued. This would simplify monitoring problems and provide additional incentive for the acquisition of this class license. I suggest the addition of an "E" after the first letter of the call as a distinguishing mark. "W" calls would then be "WE," "K" calls would be "KE" and "WA" calls could be "NE," with the remainder of the call unchanged. It would also be an additional incentive if a desired two-letter call could be requested upon paying the $20 special call fee. This would permit two thousand two letter calls in each call area.

K6BX

Directory Extra News Letter #17 just arrived. It has about the equivalent of 20 pages of 73 devoted to RM-499 and ARRL. Cliff has published many of the letters I have received giving inside dope on how bad things really are at League HQ. Unfortunately much of it is written in Cliff's own rotten style. See for yourself, if you want to know what's what. Send 50c to K6BX, Box 385, Bonita, California.

You Test It

One of the best tests of a new piece of equipment is how it works in the average ham shack. Lab tests of new gear frequently miss important operating points which turn up when the unit is used for a few days of normal operating.

If you're the kind of fellow who like to buy something when it is new to the market you might consider taking a little extra time after using it and writing up a users report for everyone and submitting it to 73. If you're first and have done a good job of evaluating the unit then you stand to get from $25 to $50 for the report . . . which might even help pay for it a little.

Updating the ARRL

Severe limitations are built into the ARRL Constitutions and By-Laws which have prevented many good men from being nominated for the position of Director. Under By-Law 8 a Conditional or Technician licensee cannot run for Director. This immediately eliminates over 100,000 licensed amateurs from holding this office. In some areas this makes the selection of a candidate extremely difficult since almost all amateurs are Conditional Class.

Article 12 of the ARRL Constitution is a holdover from the dim dark ages and has been a major obstacle to members wishing to nominate experienced hams to Directorship. This one says that no one shall be eligible for the office of Director, Vice Director or President who is commercially engaged in the manufacture, sale or rental of radio apparatus capable of being used in radio communication, or is commercially engaged in the publication of radio literature intended in whole or in part for consumption by radio amateurs.

The last part is OK . . . it makes sense for the leading amateur radio publishing house not to allow control of the company to fall into the hands of another publisher. But we have a number of manufacturers who sell to hams and distributors who sell to hams who would be invaluable to us as Directors of the ARRL. There is nothing like having your life's work in the industry to know intimately what is going on. Yet these fellows are not permitted to give us the benefit of their knowledge and experience. Directors, voted in by the amateurs in their sections, would undoubtedly bend over backward to keep from having any possible conflicts of interest. I believe that the end result would be far superior to the persent system. I've received reports of three serious cases of manufacturer influence, involving top officials. I see strong indications of at least one other. I don't think that these incidents could possibly have happened if anyone from the amateur industry had been on the Board of Directors.

Outstanding Amateur

The nominations for the Institute of Amateur Radio Outstanding Amateur Award are starting to come in now and we plan to have our first listing of these nominations in the June issue. Please send us a letter giving all the particulars you can on any amateur you know that you believe rates this award.

The first award went to Merrill Swan W6AEE for his pioneer work in amateur RTTY. Our second award goes to Don Chesser W4KVX for his untiring efforts to provide communications for those interested in the world of DX. Don has been devoting his entire life to the publication of his DX Bulletin ever since the first issue back in May 1957. Don is to a great degree responsible for the current high interest in DXing and DXpeditions. His bulletin, which comes out about 40 times a year, keeps operators interested in working DX up to date on current activities.

Few amateurs have worked as hard and long as Don in the interests of amateur radio.

. . . Wayne

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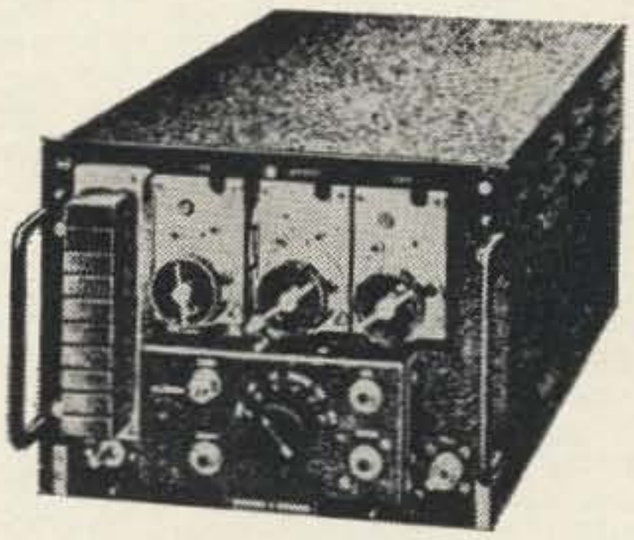

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2—SIMPLIFIED MATH FOR THE HAM-SHACK—K8LFI.—This is the simplest and easiest to fathem explanation of Ohm's Law, squares, roots, powers, frequency/meters, logs, slide rules, etc. If our schools ever got wind of this amazing method of undestanding basic math our kids would have a lot less touble. **50c**

3—INDEX TO SURPLUS—W4WKM.—This is a complete list of every article ever published on the conversion of surplus equipment. Gives a brief rundown on the article and source. **$1.50**

4—HAM-TV—WØKYQ.—Covers the basics of ham-TV, complete with how to get on the air for under $50. Not the usual theory manual, but a how-to-do-it book. **$3.00**

6—SURPLUS TV SCHEMATICS.—You can save a lot of building time in TV if you take advantage of the real bargains in surplus. This book gives the circuit diagrams and info on the popularly available surplus TV gear. **$1.00**

7—AN/ARC-2 CONVERSION.—This transceiver sells in the surplus market for from $40 to $50 and is easily converted into a fine little ham transceiver. Covers 29 mc (160-80-75-40 meters). This booklet gives you the complete schematic and detailed conversion instructions. **$1.00**

8—AN/VRC-2 CONVERSION.—Completely different from the ARC-2. This book gives you complete instructions on converting the inexpensive VRC surplus gear into a six meter wide band FM transceiver. There are probably over a thousand stations now operating on 52.525 mc around the country. Join the crowd. Fun. **$1.00**

9—COILS—K8BYN.—Basic book which covers the theory and practical aspects of the many different types of coils found in ham work. Well illustrated. **50c**

11—16TH EDITION RADIO HANDBOOK—by Bill Orr W6SAI. This fantastic book is loaded with the most understandable theory course now available in our hobby plus dozens of great construction projects. This is the best ham handbook in print by a wide margin. Easily worth twice the price. **$9.50**

12—CW—W6SFM.—Anyone can learn the code. This book, by an expert, lays in a good foundation for later high speed CW ability. **50c**

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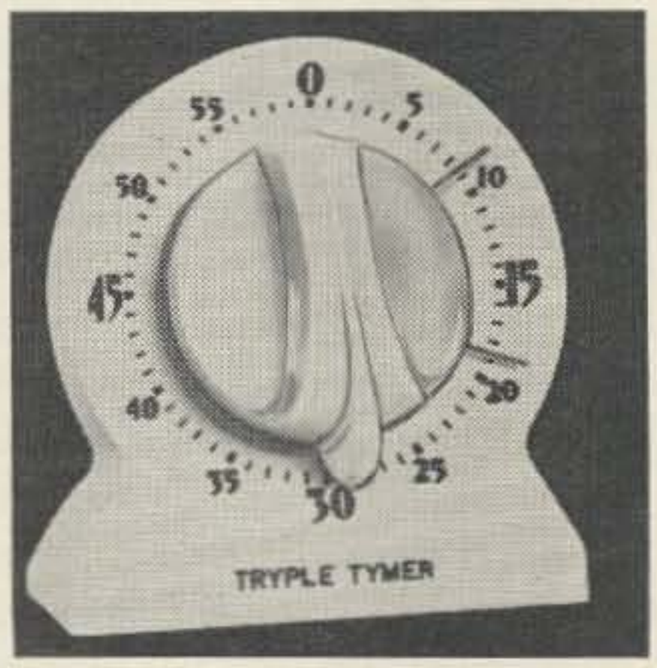

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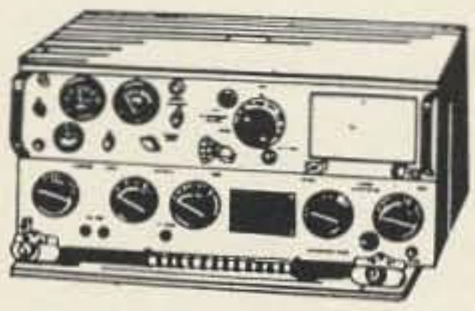
AN/ART-13 100-WATT XMTR
11 CHANNELS
200-1500 Kc
2 to 18.1 Mc



Collins Autotune Transmitter, extremely stable and suited for side band. Written up in QST Jan. issue 1964. Used, with tubes. $50.00

We have parts, what do you need?

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Used, good shape.

Model	#28	$30.00
	#32	50.00
	#32M	50.00
	#C-280	60.00
	#C-280M	70.00
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TO-53 case, 85 WATT 60 volt Silicon
$1.00 each

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2 for $1.00

2N696	NPN	2 Watt	80 MC	TO-5
2N697	NPN	2 Watt	100 MC	TO-5
2N711	PNP	150 MW	150 MC	TO-18
2N706	NPN	1 Watt	400 MC	TO-18
2N784	NPN	1 Watt	200 MC	TO-18

SILICON CONTROL RECTIFIERS

PIV	2 amp	20 amp
50	1.00	2.50
100	1.60	3.00
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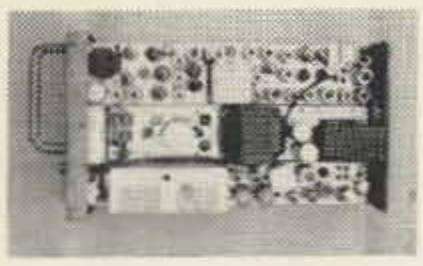
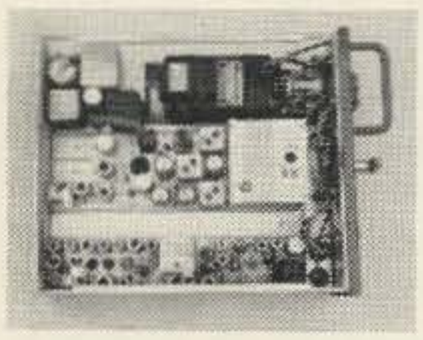


FMTR-41V



FMTR-80D

MODEL	VOLTS	WATTS	FREQUENCY RANGE	CONDITION	PRICE
FMTR-41V (1C)	6V	10W	30-50MC	Dirty, but complete	29.95
FMTRU-41V (1C)	6V	10W	150MC	"	29.95
FMTRU-41V (1D)	12V	10W	150MC	"	39.95
FMTRU-41V (1C)	6V	10W	150MC	Dirty, but complete; front mount Sensicon Receiver & Transmitter	34.95
FMTR-80D	12V	30W	30-40MC	Clean less Dynamotor	24.95
				Clean With Dynamotor	39.95
FMTR-80D	12V	30W	40-50MC	"	44.95
FMTR-80D	6V	30W	30-40MC	"	34.95
FMTR-80D	6V	30W	40-50MC	"	39.95
FMTRU-80D	6V	30W	150MC	Clean, With Sensicon or unchannel receiver	44.95
FMTRU-80D	12V	30W	150MC	Clean, With Sensicon or unchannel receiver	52.95
FMTR-140D	6V	60W	30-40MC	Clean With Dynamotor	32.95
FMTR-140D	6V	60W	40-50MC	"	39.95
FMTRU-5V	6V	10W	150MC	Very Clean With Case	25.95
FMTRU-5V	12V	10W	150MC	"	29.95
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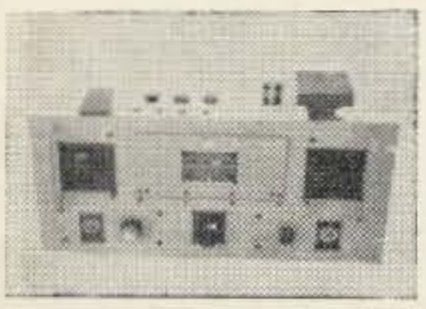

TT-63

All equipment FOB Boston, Massachusetts.

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Propagation Chart

EASTERN UNITED STATES TO:

GMT -	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	7	7	7	7	7*	14	14	14	14	14
ARGENTINA	14	14	14	7*	7	7	14	14	14	14*	21	21
AUSTRALIA	14	14	14	7	7	7	7*	7	7	7	14	14
CANAL ZONE	14*	14	14	7	7	7	14	14	14	14	14*	21
ENGLAND	7*	7	7	7	7	14	14	14	14	14	14	14
HAWAII	14	14	14	7	7	7	7	7	14	14	14	14
INDIA	7*	7	7	7	7	7*	14	14	14	14	14	14
JAPAN	14	14	7	7	7	7	7*	7*	7	7	14	14
MEXICO	14*	14	14	7	7	7	14	14	14	14	14	14
PHILIPPINES	14	14	7	7	7	7	7*	7*	14	14	14	14
PUERTO RICO	14	7*	7	7	7	7	14	14	14	14	14	14
SOUTH AFRICA	14	7	7	7	7	14	14	14	14	14	14	14
U. S. S. R.	7	7	7	7	7	14	14	14	14	14	14	14
WEST COAST	14	14	14	7	7	7	7	14	14	14	14	14

CENTRAL UNITED STATES TO:

ALASKA	14	14	14	7*	7	7	7	7*	14	14	14	14
ARGENTINA	14*	14	14	7	7	7	14	14	14	14	21	21
AUSTRALIA	14*	14*	14	14	7	7	7	7	7	7	14	14
CANAL ZONE	21	14	14	7*	7	7	14	14	14	14	14*	21
ENGLAND	14	7	7	7	7	7	14	14	14	14	14	14
HAWAII	14	14	14	14	7	7	7	7	14	14	14	14
INDIA	14	14	7	7	7	7	14	14	14	14	14	14
JAPAN	14	14	14	7	7	7	7	7*	7	7	14	14
MEXICO	14	14	14	7	7	7	7	14	14	14	14	14
PHILIPPINES	14	14	14	7*	7	7	7	7*	14	14	14	14
PUERTO RICO	14*	14	14	7*	7	7	14	14	14	14	14	14
SOUTH AFRICA	14	7	7	7	7	7	14	14	14	14	14	14
U. S. S. R.	7	7	7	7	7	7	14	14	14	14	14	7*

WESTERN UNITED STATES TO:

ALASKA	14	14	14	7*	7	7	7	7	7*	14	14	14
ARGENTINA	14*	14	14	7*	7	7	7	14	14	14	14*	21
AUSTRALIA	14*	21	14*	14	14	7*	7	7	7	7	14	14
CANAL ZONE	14	14	14	7*	7	7	7*	14	14	14	14	14
ENGLAND	7*	7	7	7	7	7	7*	14	14	14	14	14
HAWAII	14	14*	14	14	7*	7	7	7	14	14	14	14
INDIA	14	14	14	14	7	7	7	7*	14	14	14	14
JAPAN	14	14	14	14	14	7	7	7	7	7	14	14
MEXICO	14	14	14	7	7	7	7	14	14	14	14	14
PHILIPPINES	14	14	14	14	14	7	7	7	14	14	14	14
PUERTO RICO	14	14	14	7	7	7	7*	14	14	14	14	14
SOUTH AFRICA	14	7	7	7	7	7	7	14	14	14	14	14
U. S. S. R.	7	7	7	7	7	7	7	14	14	14	14	7*
EAST COAST	14	14	14	7	7	7	7	14	14	14	14	14

Good: 1-3, 10-11, 15-18, 22-25

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Poor: 4-6, 19

Es: 6-9, 13-15, 21-24

(High MUF and/or freak conditions)

J. H. Nelson

*** Means next higher frequency may be useful.**

LEO MEYERSON WØGFQ

IT'S HERE WE'VE GOT IT

THE NEWEST MOST POWERFUL— MOST COMPACT— FULL COVERAGE 80-40-20 METER 300 WATT-SSB/CW ANYWHERE!!!

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ONLY $17.00 MONTHLY
ON WRL
CHARG-A-PLAN
$349.95

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Most power-output of any three-band transceiver today; smallest 300 Watt SSB/CW transceiver; full coverage on 80-40-20 meters; SSB upper and lower sidebands; newest and best 6-section crystal filter; highest receiver sensitivity. Shifted carrier CW eliminates "leap frogging"; hybrid circuitry—transistorized AVC/AUDIO/VOX; dual vernier tuning; handsome styling: modern 4-color brushed aluminum panel. Perforated steel cabinet, hinged top; meter & VFO beautifully illuminated, plus many other features.

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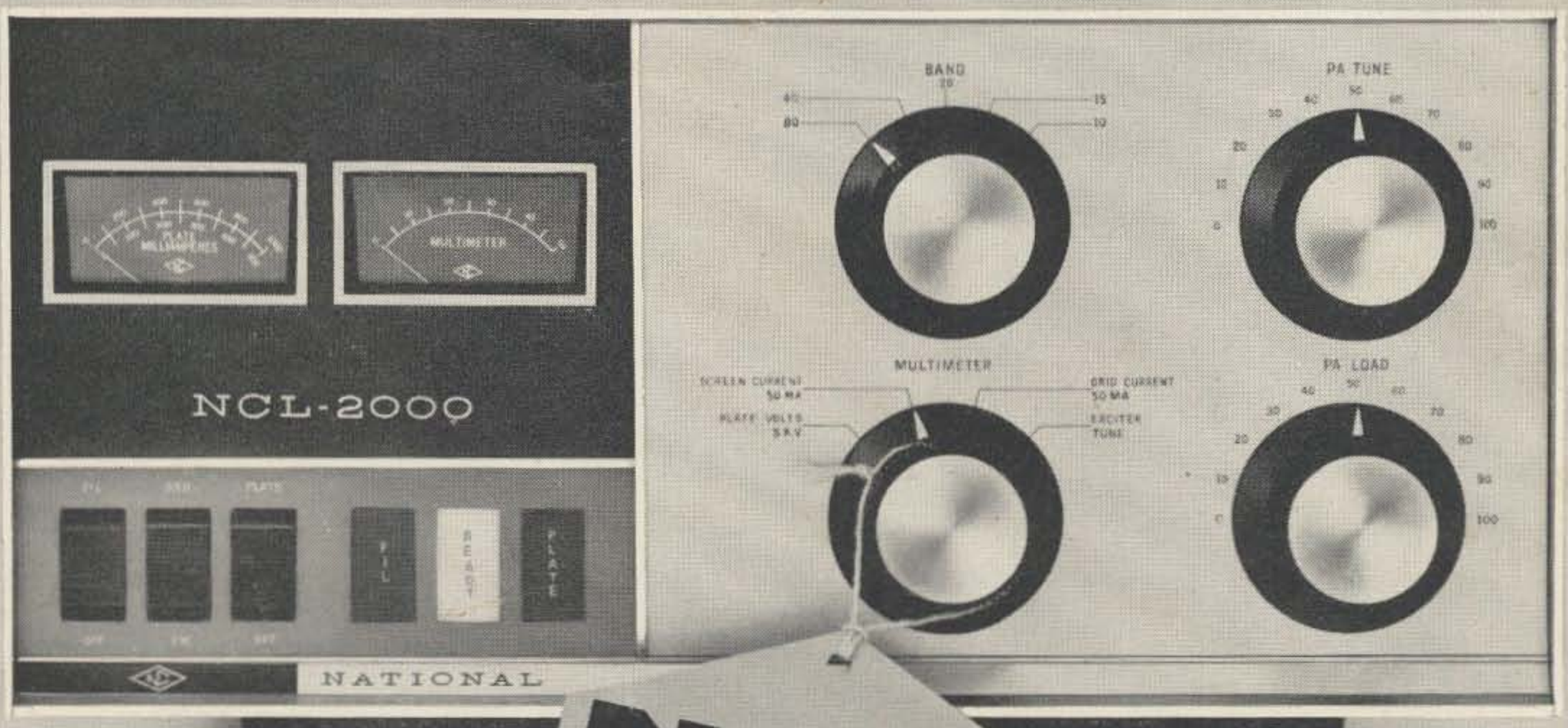
$~~X~~585

Up to now you've had to pay at least $1585 for a commercial grade 2 KW amplifier. No longer. The brand-new National NCL-2000 maximum kilowatt is only $585, including its built-in power supply. Up to now most amplifiers in the price range of the NCL-2000 have been 500 watt jobs, usually using a whole string of low power tubes straining to deliver a peak kilowatt. Not now. The new NCL-2000 is a real brute of a desk-top amplifier for the 80 through 10 meter bands that was designed from power supply to output tubes to loaf along at a "D.C." kilowatt . . . 2000 watts PEP input and 1300 watts of peak output into your antenna on any band. Operate CW? AM? RTTY? The National NCL-2000 is rated for full kilowatt operation in these services.

The output tubes in the NCL-2000 are a pair of RCA 8122 ceramic tetrodes designed specifically for high power SSB service, and 800 watts of available plate dissipation assure low distortion, linear operation at full output. The NCL-2000 utilizes a passive, untuned grid circuit, so that it may be adjusted to allow excitation to full output from any transmitter or transceiver providing from 20 watts to 200 watts of peak drive. The passive grid circuit in the NCL-2000 allows its use as a dummy load for easy exciter tune-up with amplifier plate voltage removed!

The National NCL-2000 is a particularly handsome unit . . . styled to complement any ham shack or equipment (of course we think it looks best next to our own NCX-3)! Compare these features with any unit on the market at <u>any</u> price □ one kilowatt average input, 2000 watts PEP on all bands □ may be driven to full output with 20 to 200 watts from the exciter □ ALC output for use with exciters incorporating such provision □ separate plate and multi-meters □ tune-up at 1 KW level to comply with F.C.C. □ built-in dummy load with multi-meter relative power indication for optimum exciter tune-up with amplifier plate voltage removed □ all changeover relays incorporated for use with either transceiver or transmitter-receiver combinations □ automatic switchover to exciter-only when plate voltage is removed □ most complete safety and overload protection, including interlock, automatic shorting bar, time delay and current overload relays □ National's exclusive one-year warranty.

Your National Dealer will have the NCL-2000 in June . . . why not call him today to reserve yours for immediate delivery.



NEW NATIONAL 2000 WATT LINEAR AMPLIFIER

ONLY $585

ADDITIONAL NCL-2000 SPECIFICATIONS Frequency Range: 80 through 10 meter bands plus overlap at band edges. Output Impedance Matching Range: 40-60 ohms. Input Impedance: 50 ohms nominal, unbalanced. Distortion Products: 30-45 db signal to distortion ratio at full rated output. Noise: NLT 40 db down. Ambient Temperature Range: to +45°C. Ambient Humidity Range: to 90%. Altitude: To 8,000 ft. Primary Power: 115/230 V. A. C. 60 cycle single phase, 3 wire, neutral ground; current 15 amperes max. at 230 V. Tube and semi-conductor complement: 2 RCA 8122 output tubes, 13 semi-conductors for rectification and regulation. Size: 7⅝" H, 16¼" W, 12¾" D. Weight: 62 lbs.

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